The Outlines of Pathology

BY

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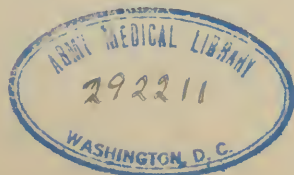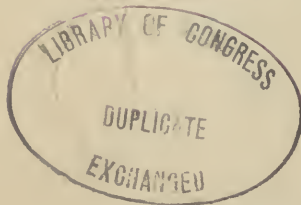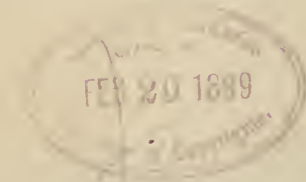
PREFACE

These Outlines of Pathology are a series of Lectures, with additions, delivered to the class in Pathology during the Fall Term, 1898, and published for the use of the students of the A. S. O. They are not intended to take the place of the many complete manuals of Pathology, but are simply arranged in such a way that the outlines of the subject are brought to the notice of the student, so as to enable him to become more familiar with the subject and increase his desire to get more insight into the realms of Pathology, which an interest in the Science is sure to produce and without which the study would be both uninteresting and unprofitable.

It is with the hope that these pages will accomplish the purpose for which they were intended and that the students of the A. S. O. will be the better fitted for the practice of the profession which they have selected, with profit to themselves and the suffering humanity they may be called upon to minister, and that they may always remember that the best in any profession must not depend only on the items which such fragmentary writings as these Outlines can give, but that research must be made along original lines, as well as systematic study of the subjects by reading of the Manuals which have been prepared after years of experience by the able writers of the present. If such be accomplished the writer will be well satisfied and repaid for the labors incident to the preparation of this little book.

I wish to express to all from whom I have gained any knowledge of the subject my obligations, as well as those who assisted me in the passing of these pages through the press, notably the printers and my brother, D. Littlejohn, Ph. B., M. D.

NOTES ON PATHOLOGY.

INTRODUCTION.

The study of Pathology requires a previous knowledge of the physiological and histological branches of science. We understand by the term pathology, that it is the science which deals with disease, either as disorded function or disordered structure

In order that a part of the body may be healthy and remain healthy, there must be no deviation from the standard, either as regards the structure or function of the part. If there be deviation in either direction, we have on the one hand an organic, and on the other a funtional disease. The mere fact of a variation from the normal standard, implies an interference with the performance of some of these normal conditions, either as to quantity or quality of blood, assimilative process. Channels through which the blood flows, or the nervous mechanism which controls these functions. To arrive at a proper basis for the normal standard, an extensive study of the healthy organs and structures has been made, and that condition appearing most common was considered as a type of the normal.

All deviations from a normal standard are not disease. We have several deviations from this normal standard, we might classify them under three head:

(1) Malposition which signifies that an organ is out of the normal position in relation to the adjacent organs, or else the structures around the organs may be out of the relation usualy borne to the particular organs e. g., the liver may be out of relation to the surrounding parts, or the parts out of relation to the normal liver. The same is also true of the heart. Such conditions may be congenital or develop afterwards The congenital need not be permanent e.g., hernia—although usually it is so.

(2) Malformation is some deviation in development or else in structure from the normal standard. It may be the result of disease, but is not necessarily so, as the condition may be, and frequently is acquired as fractures, ankylosis of joints, etc.

(3) Morbid conditions, which we speak of as disease. This as already stated may be organic or functional. We have, perhaps, the best illustration of this in the case of the heart, where we do find a functional murmur existing, which is claimed by some to be really organic, seeing that it is probably due to an imperfect nutrition of the cardiac muscle as well as the true organic lesion indicated by the murmur and its location on the thoracic walls.

As all cases are due to some cause, it is necessary that this be one of the points to investigate, in connection with the different abnormal conditions

which we consider. We have a general term applied very frequently, which we must consider in this connection, seeing that it is frequently spoken of as being a factor in the development of certain diseased conditions.

This term is the constitution of an individual. Do we really understand what we speek of, when we say that ones constitution has to do with this, that, and the other condition. Let us ask what is the constitution of an individual? It is everything that is inherent in the bodily framework of that individual. A difference in constitution depend upon variations within certain limits, for the most part in the various items of the bodily framework. Let us illustrate this. Each species of animal has a different constitution, so also has each individual member of these groups. The races which inhabit our world, for example, have different constitutions, and these are manifested by variationsin— some cases very small—sufficient to enable us to note the bifference in the configuration of the skull, of the face, the color of the skin, the peculiarity of the hair and other such minute peculiarities. It is interesting here to notice this peculiar type of inheritance that the ovum seems to have within itself, something which renders it almost certain to comply with the peculiarities of the ancestor. The constitution of each is determined in the ovum, a matter of inheritance and inseparable from the framework of the body. We have these peculiarities at times approaching to a pathological condition. for example, the condition known as Haemophilia where persons of this diathesis bleed profusely from the slightest injury, prick of a pin or extraction of a tooth. Here we have a peculiar hereditary condition which misses a generation, coming from the female side of the family, but manifests itself only in the male. In other words, it passes from mother to son, the mother not being affected. Other similar conditions are, Ichthyosis or fish skin and pseudo-hypertrophy of the muscles, both hereditary the former transmitted similarly to haemophilia the latter affecting male children usually about three years of age, preceding paralysis and, frequently at least. terminating fatally at begining of manhood.

Further, we have a special constitution for the different organs of the body. Thus we have varying susceptibilities of the different organs of the body to the inroads of disease. This is well seen in Tuberculosis. a disease due to a micro-organism—never, we believe, hereditary—which certainly is carried through the different organs of the body, yet we know the chief organ to be attacked and destroyed is the lung, the liver, e. g., being very rarely affected, although the bacilli are more frequently deposited there than elsewhere. In this connection it is worthy of notice. that in animals, the liver is much more frequently affected than the lung. Syphilis, although similar in many respects to tuberculosis, affects the human organs the reverse of tuberculosis, the liver being most frequently and the lung least frequently affected of the various organs of the body. We see then, that we have peculiar susceptibilities, not merely of races and individuals. but also of the different organs of

the body. Thus we see the importance of the term constitution, and the important part it plays in the role of disease.

DISEASE we may define as being an alteration or change in the structure of a tissue, giving rise to alteration of function, such function being beyond the limits of the nor.nal.

HYPERTROPHY is a condition produced by anything which causes the supply of blood to be more than is required for normal nutrition. It is an increase of functional power, which has tendency to remain distinctly in excess of the normal for the particular tissue under the conditions existing, e. g., an organ may be a given weight in a child, which would be normal for the adult but hypertrophic in the child.

It may arise without an extra demand for work, the nutrition nevertheless being supplied. This is what is spoken of as congenital impulse. It is simply an expression of ignorance in regard to the initial cause for the increased phenomenon of nutrition.

There are several kinds of hypertrophy, simple where we have an increase in size of the cells and multiple or numerical where there is increase in number of cells. We have also a physiological hypertrophy, all are physilogical to a certain extent, but the variety referred to is seen in the enlarged mammary gland or the uterus, a preperation for increased functional activity.

It is noteworthy that even with the increase of nutrition and other suitable conditions hypertrophy is limited in its extent. The older the individual usually this limit is reached the sooner, evidently the arteries become inadequate or unable to transmit the demanded blood for further growth.

ATROPHY is the opposite condition to that above described. It is diminished functional activity and nutrition, associated with an alteration in the structure of the tissue involved, for this reason it has been spoken of as degenerative atrophy; and it is assumed that in most cases of atrophy there is a degeneration of cells. Similar to the condition of hypertrophy, atrophy may be either (a) Simple which includes those conditions where no degeneration or loss of cells takes place, and (b) numerical where actual diminution in the elements of the part takes place. Where there is failure in the assimilation of the nutrition supplied, the condition is said to be active, when there is lack of nutrition it is called passive.

Atrophy may result from pressure, disuse, faulty nutrition, inflammation or defective nerve force—trophic defects.

HYPERPLASIA means the increase in the connective tissue of an organ. It is also applied to conditions where there is a disproportionate increase of one element in an organ.

METAPLASIA is where tissues of a type change from one variety to another variety of the same group. This is seen in cases where one variety of epithelium changes to another. It never means that one kind of tissue may change to another dis-similar tissue.

HETROPLASIA signifies a growth of a normal tissue in an abno mal position, e. g., cartilage or bone in glandular structure, such as the ov ry etc.

HYPOPLASIA signifies a want of development, illustrated by the condition known as dwarf, it may begin before or after birth.

APLASIA signifies an absence of development entirely, e. g., the kidney where the artery has become obliterated.

INFLAMMATION—According to Saunderson this condition is a succession of changes taking place in a tissue, provided the injury is not sufficient to destroy its vitality. Inflammation is in reality the reaction of the living tissue against tendencies to destruction or death. It may be defined "as an effort on the part of the organism to render inert, noxious elements introduced from without or arising from within, thereby producing a preverted condition of the capillaries, attended by pain, heat, redness, swellling and a deposit of new inflammatory material." This is an elucidation and modification of Stutton's explanation. Inflammation was originally supposed to be an increased nutrition, but it is now looked upon as deranged or defective nutrition.

We may have it originating from various causes: (a) violence or chemical action. (b) chemical products of putrefaction. (c) infective micro-organisms. In fact we have it from any cause sufficient to produce disturbance in the circulation with degeneration. but not destruction of the tissue involved.

As a result of the irritation we have a series of changes taking place which may be described thus:

(a) In the blood-vessel. A molecular change results from the action of the irritant and we have a brief period of contraction which is succeeded almost instantly by dilatation, afterwards by sacculation.

(b) Within the blood-vessel. The current is at first accelerated, then retarded, then there is oscillation, and finally stagnation or stasis. When the blood stream becomes slower the blood itself is somewhat split up into its component parts. That is to say, we have an axial stream of red cells and a peripheral or circumferential stream of white cells. We have a permeating of the wall of the vessel by these white cells. The white cell is supposed to fall out of the axial stream. on account of the difference of density of these cells. The leucocytes or white cells make their way from the inside of the vessel to the perivascular tissues. along with the liquor sanguinis. and probably other constituent elements of the blood, so that we have:

(c) The changes in the perivascular tissues. These consist in the exudation of fluid and cells from the blood channels, taking place mainly it is claimed through the veins. We do not, however, quite understand how we may not have, some at least, passing through the capillaries, seeing that histologically the walls of the capillaries are more suited to this purpose than

the veins even.   These cells pass out by their amoeboid movements assisted by the alteration in the vitality of the structure of the vessel.

Inflammations   vary considerably   in some of the details of the process, sufficient to make these differences serve as a basis for more accurate   classification.   We might   classify all   under the heads of simple and infective or we may   use the clinical   condition, and   speak of the acute,   subacute and chronic, or we might go still further and use term characteristic of the pathological condition present, such as sero-fibrinous, fibrinous and such like.

It is doubted by some whether we really   have a perfect simple inflammation, writers   such as Senn and those agreeing with him,   would seem to think that all are really   specific or infective.   We think that there is such a condition as simple inflammation, characterized by its spreading only in the tissues affected, and exemplified by such a condition as dermatitis, resulting from the effects of the sun.

The infective type of inflammations are those which have their origin in a micro-organism.

A variety of inflammation is spoken as idiopathic, where the cause is unknown, but we venture to think no such type exists, unless it be in the minds of those who know no more than shield their ignorance by mere phraseology. We are glad that some writers have courage to say that it is not an accurate type of inflammation.

We have such inflammation as croupous and diphtheritic to consider, and to note this distinction, we find that the real difference consists in this, that in the former the inflammatory exudation coagulates superficial to the mucous membrane and can be removed without any bleeding, whereas, in the latter, the deposit takes place in the mucous membrane and when removed causes bleeding.   Again, there are serous and serous-fibrin or plastic inflamations, where the conditions depend on the relative proportions of fibrin or serum and fibrin or of serum alone, which is present in the particular case, in the serous variety the exudate is entirely serous and hence non-coagulable, while in the serofibrinous the exudate contains both serum and fibrin, and so it is partly coagulable.   This explains the condition of accumulation on fluid in serous cavities at one time, and the adhesions or obliteration of such cavities at other times.

THE TERMINATIONS OF INFLAMMATION are varied.   We might say that as a rule acute inflammations terminate either in resolution or else suppuration, that the chronic form usually results in a new formation of tissue, but scarcely sufficiently accurate to cover the changes following the inflammatory state.   We classify the terminations, therefore, and say that we may have the condition returning to the normal, the circulation becoming re-established and the exudation carried away by the lymphatics, which means that the inflammatory condition has terminated in resolution.   Again, we have the exudation becoming granulation tissue, and if it is in spaces where the granulation surfaces come

together we have a union of these surfaces and the condition terminating as an obliterate or adhesive inflammation. Provided that this granulation tissue is not on the walls of cavities but in the tissues we have the further changing of this tissue into a fibrous tissue, and so we have another change or termination as a new formation. We might describe the process briefly as follows: After the exudation and prolifieration of cells has taken place—embryonic tissue stage—there is the formation of vascular loops and ultimately complete vascularization—the granulation tissue stage—followed by the development of the fibrous tissue. Thus we have the process of the formation of new growths or new formations exemplified, both in the repair or union of wounds, and also in the regeneration of diseased tissue.

Still further we have inflammations terminating in destruction and we may have three different varieties of destruction. If micro-orgrnisms gain an entrance they cause a liquefaction of the embryonic tissue and suppuration results, which if it be limited and in the tissue forms an abscess, but if superficial would be an ulcer. An abscess is a circumscribed cavity of new formation containing pus. It has been said that an abscess is a closed ulcer and that an ulcer is an open abscess. If the destruction of tissue is molecular it is an ulcer, but if it is "en masse" or in bulk it is a slough. Should the condition extend further there is that form of destruction which is known as gangrene. Ulceration and gangrene may be produced by causes not inflammatory in the ordinary sense of the word, but they frequently produced by it.

TUMORS.

The term tumor taken literally signifies swelling, and was formerly used in this sense, but in its modern use it indicates growth, which grows independently of the needs of the organism. A tumor is said to be typical when the details of its structure are strictly like those of the corresponding normal tissue. A—Typical when its structure varies from the normal type chiefly in respect that the cellular elements are much more numerous and that the intercellular substance loses prominence. Homologous when it exists in a tissue of its own kind. Heterologous when it is present in a situation where no normal tissue of its kind exists. Tumors are also classified according to their effect as to malignancy or simplicity, and although fairly correct from a clinical standpoint is not correct from a pathological or scientific. A more correct classification, taking their origin as the basis, would be: (a) Epithelial, (1) adult or typical structure; (2) embryonic or a-typical structure. (b) Connective tissue, (1) adult or typical; (2) embryonic or a-typical.

The cause for the formation of these tumors is still obscure. The most common theory is Cohnheim's inclusion theory. It is that the tumor is primarily a piece of embryonic tissue which, in the process of development and growth, has been, as it were, left over. It has retained its embryonic powers of growth and is not subject to the general laws which control the growth

of the tissues. In support of this view may be cited, cartilaginous tumors in bone, and in sub-cutaneous tissues; muscular tumors in the kidney; mucous tissue tumors and frequency of tumors in congenial moles.

Others are (a) inheritance, (b) injuries. irritation and chronic inflammation, (c) age, which is an important factor in the localization and development of certain kinds of tumors, (d) parasitic microbes, whhich are supposed to be the principal elements in the production of malignant tumors.

Growth and extension of tumors: A tumor may simply grow by new formation of its own tissue and its effect on neighboring structures be mainly mechanical, when it is called simple or innocent. On the other hand it may grow into and infiltrate neighboring tissues and is then called malignant. Another feature of malignancy is what is termed metastasis, by which is meant the further development of the tumor in parts at a distance from the original seat. This is brought about by the lymphatics and blood, and metastastic growths produce the exact tissue of the original to the smallest detail. Tumors may undergo the same retrograde changes as normal tissues, namely, fatty degeneration, calcareous infiltration, necrosis, ulceration and also hemorrhages. Their effect on the system show themselves in aneamia, weakness, and if growth is rapid, emaciation, conditions which are embraced by the term cachexia.

Typical tumors. These are the simple tumors.

1. FIBROMA—A tumor composed of white fibrous tissue which may grow wherever fibrous tissue exists, well demarcated, dense, hard, grayish or pink-ish in color. Microscopically it consists of waving bundles of fibrous tissue interlacing in all directions with oval or fusiform connective tissue, lying upon each bundle.

2. LIPOMA.—A localized hypertrophy of adipose tissue circumscribed, lobulated, sometimes pedunculated, occurring wherever fat is present. They are frequently multiple, that is to say, more than one being present. And sometimes they become pendulous. Those of the appendices eppiploicae are pendulous from the first and may get severed, as may also small lipomas of the synovial fringes. Microscopically the structure corresponds entirely with ordinary adipose tissue.

3. CHONDROMA.—Generally round and distinctly in capsules, if large they are usually lobulated. They consist of cartilage and may be found where cartilage exists, being either hyaline or fibrous, generally the latter and intersected by fibrous bands which carry blood vessels. If in connection with a pre-existing cartilage it is called an ecchondrosis, but if along with other tissues it is called an enchrondroma. The former is comparatively infrequent and insignificant, occurring chiefly in the nose and larynx, trachea and ribs. The latter is of greater clinical significance, occurs mostly in connection bones, occasionally with glands as the testes, ovaries, mammae and

salivary glands. Those in connection with the bones may originate in the medullary canal, or on the surface. The one being spoken of as central the other peripheral. The central variety occurs chiefly in early life and especially in the fingers and toes. The peripheral are most frequently in connection with the femur and the pelvis. Chrondromata are frequently mixed with other tissues, the glandular ones are liable to transform into mucous tissue, those of bone are liable to ossify.

4. OSTEOMA.—A tumor composed of bone. It may be met with either as an outgrowth of bone itself, when it is called exostosis, or in certain soft structures of the body, as the dura mater, arachnoid, brain substance, eyeballs, lungs, skin or testicles. In connection with bone three forms are distinguished: (a) Spongy exostosis. This tumor consists of spongy bone with a layer of cartilage on its surface. It mostly occurs at the epiphysis of the long bones and is derived primarily from the epiphysical cartilage; also frequently on the last phalanx of the great toe. The growth of this tumor takes place during childhood, and just as the cartilage from which it originates ossifies, it also ossifies. (b) Ivory exostosis: Mostly found on bones of the head and on the pelvis, scapula and some times on the great toe. It is usually rounded or tuberculated, most commonly single, but it some times occurs as a multiple growth. On the head these tumors may grow from the external or internal table, and consist of dense bone such as forms the shaft of a long bone. (c) Hyperostosis and periostosis: These are not properly tumors but are simply localized thickening of bone or portions of bone or the periosteum which covers the bone.

5. MYOMA.—A tumor composed of muscular tissue, usually of the nonstriated type, but a rare congenital tumor also occurs in connection with the heart, kidneys, ovaries and testes in which the fibers are striated. The nonstriated myoma occurs where involuntary muscle is normally present, the uterus chiefly but also in the gastro-intestinal tract, the skin and the prostate gland in the aged. It may be lobulated or smooth, sessile or pedunculated, and varies in size from a nodule no larger than a pea to a mass the size of a persons head. They are dense and firm, and on being cut the surface resembles that of a dense fibroma. The fibers appear in wavy undulating lines or in concentric circles. As smooth muscle is most frequent in the walls of mucous canals and cavities, it is there that myoma usually originates. A myoma of the uterus may remain in the substance of the wall itself, when it is called intramural, or it may slip inwayds so as to appear under the mucous membrane, when it is known as submucous, or it may grow outwards under the serous coat and become a subserous myoma. Microscopically these myomae have a resemblance to ordinary fibroma, in fact, so close is the resemblance that diagnosis is practically impossible without careful staining. The distinguishing features being that the cells are of much greater abundance

and the neuclei more closely set together and having a rod shape. The tumor is of slow growth and is liable to retrograde changes, e. g., fatty degeneration or calcareous infiltration, and in this way there is shrinking of the mass and some times the formation of cysts resulting.

6. NEUROMA.—A rare tumor composed of true nervous tissue met with either in the course or at the divided extremities of nerves. Other tumors may occur in the course of nerves, they are sometimes designated as false neuromas. The ordinary or true neuroma may be composed either of medulated or nonmedulated nerve fibres, supported by more or less ordinary connective tissue. The painful subcutaneous tumor of Wood, the peculiarity of which is, that when touched even lightly, pain of an agonizing character is experienced is most probably a dense neuroma.

7. ANGIOMA.—A tumor composed of blood vessels. There are three different varieties of this growth: (a) Capillary or plexiform. These consist mainly of capillaries and to some extent also the smaller arteries and venules. They mostly occur in the skin, are nearly always congenital and frequently multiple. (b) Vanous or varicose naevi, consisting of dilated veins and situated similarly to the capillary variety in the skin. These are spoken of as mixed naevi. (c) Cavernous. These consist of tissue analogous to that in the corpus cavernosum mainly consisting of a trabeculae of connective tissue lined with endothelium and containing a few muscular fibre cells so that the issue is practically divided into spaces, these spaces freely communicate with one another and are filled with blood. They are not unusually congenital and may result from a development of the capillary or venous types just referred to. They are most frequently met with in the skin, especially of the face and the head, where they are erectile, can be emptied of blood and are more limited than ordinary naevi; or they may be found in the liver, especially near its margin and resemble blood clot with distinct capsule or they may be found under the periosteum.

8. LYMPHANGIOMA.—Is a term applied to a tumor connected with the lymphatic vessels and practically compares with the previous varieties of tumors in structure two forms being recognized, namely, the plexiform and cavernous. They are mostly congenital.

9. LYMPHOMA.—A tumor composed of typical lymphatic gland tissue. Its real existence as a tumor is doubted by some pathologists. There is a variety of tumor spoken of as lymphadenoma which is really a malignant form of tumor or growth in conection with the lymphatic glands of the body. They are generally distributed over the whole body. grow rapidly and quickly terminate in death.

10. PAPILLOMA.—These consist of an exaggerated papillae like those of the skin or like the villi of the mucous membrane. They are very commonly met with on the skin as warts and in the mucous membrane of the larynx,

bladder or rectum. In the bladder they may form distinct tumors with long branched papillae or there may be a large surface which is simply villous. The papillae are covered by delicate epithelium and are liable to severe and frequent hemorrhages. The pacchionian bodies are papillae which may grow to form tumors.

11. ADENOMA OR GLANULAR TUMOR—. In structure this tumor follows that of the glands in which it is situated. It occurs in the mammæ, the thyroid, the prostate, the liver, the ovaries or any other glandular structure of the body. In the mammæ their occurrence is rare, it is more commonly met with as an adeno-sarcoma or mixed tumor. In mucous membranes the soft pendulous mucous polypus, although often formed of hypertrophied mucous membrane frequently containing glandular tissue, apparently in some cases of new formation, as in the rectum, uterus or nares.

12. CYSTOMA.—These are cavities filled with fluid with well defined walls composed of connective tissue, usually lined with epithelium or endothelium. They may be unilocular or miltilocular, the latter may become unilocular. There are two main groups of cysts (a) cystoma proper are those which owe origin to the development of a tissue capable of giving rise to a fluid filled cavity, and (b) Cysts formed simply by the transformation of existing structures. Those cysts belonging to this group mostly arise by the accumulation of the normal contents in pre-existing cavities or canals. As example of this we have: (a) retention cysts, which are the result of obstruction of gland ducts, e. g. hydronephrosis; sebaceous cysts or wens. (b) Dilatation of pre-existing cavities without ducts, e. g. an ovarian cyst from the graafian follicle or a cystic enlargement of the saccules of the thyroid gland from the accumulation of colloid degeneration.

13. TERATOMA— this is a tumor which is composed of various structures of the body, such as skin, bone. mucles, glands, brain substance. They occur most frequently in situations were double monsters are usually attached to each other, e. g. the sacral region or still further up the back, sometimes even, on the head and neck also somewhat frequently in the ovary. These tumors, in fact, are the representation of an imperfect division of the embryo and formation of a twin pregnancy.

There are three groups of tumors which are supposed by some to be malignant and by others considered innocent. These are (a) glioma, a tumor composed of a tissue similar to neuroglia only more cellular. They occur in the central nervous system and sometimes in the retina filling up the eye-balls. (b) Psammoma or brain sand tumor this is a small tumor composed of connective tissue in the midst of which are calcareous particles from which they derive their name. They occur in the pineal gland, choroid plexus, brain substance and sometimes even in the dura matter. These tumors are probably malignant more on account of the position they occupy in regard to the central

nervous system than on account of their pathological structure. They may, in fact, be classified among that variety of tumors which has been called accidental malignant. (c) Myxoma this variety of tumor consists of the most embryonic form of mucous tissue, and is soft and in some cases almost fluctuant. Their structure approaches to, only is more embryonic than the jelly of Wharton in the umbilical cord of the foetus. This variety probably is malignant.

ATYPICAL TUMORS—these comprise sarcoma and carcinoma.

(1) SARCOMA.—A sarcoma is a tumor which originates in one or other of the different varieties of connective tissue, differing only from the connective tissues in the abundance of the cells as compared with the intercellular and in the more or less embryonic character of these cells. Sarcomas, differ from one another merely in the form of the cells and the character of the intercellular substance. It is generally possible to classify them according to the shape of the cells. (a) Round celled sarcoma. This variety grows rapidly, has imperfect limitations, is usually soft, and often diffluent. It occurs most commonly in the skin and in the subcutaneous tissue. It may also appear in bone, muscle, gland or brain. It has a greyish appearance and hemorrhage frequently takes place into the substance of the tumor by the rupturing of the thin walled vessel. It is composed of round or slightly oval cells about the size of a white blood cell or somewhat larger, between which there is a small amount of intercellular material, which may be fibrous, homogeneous or reticulated. These tumors usually have a secondary or metastatic development through the blood on account of the thin walled vessels and vascularity of the growth. This is the most malignant of the sarcomatous tumors. (b) Spindle celled sarcoma this variety is somewhat fibrous and has been called Pagets Recurrent fibroid. The growth is slow and they are much firmer in consistency ; are more defined also than the round celled variety ; occur most commonly in connection with dense connective tissue, membranes, such as the periosteum, facia or under the skin ; are composed of spindle cells with a very small amount of intercellular substance. The cells are arranged in strands which intersect one another so that the cells sometimes appear in cross sections, as if they were circular or round. Thin walled blood vessels are frequently visible in the tumor. They occasionally spread as the result of this and form metastatic growths. The peculiarity of the tumor is it is very liable to recur. Some of these spindle celled sarcomas have very small cells. These are usually soft but all variations may exist between this condition of softness and the other extreme of hardness. (c) Giant celled or myeloid sarcoma—these are soft and very often brown in color. They usually occur in connection with the medulla of bone or beneath the periosteum. In the medulla, the most usual origin, is towards the extremeties and particularly in the end of such bones as the tibia and femur. In connection with the periosteum of bone, the lower jaw is their most frequent site.

They are composed of a ground work of spindle cells with sometimes round cells through which these giant cells are scattered in lesser or greater numbers. The giant cell itself resembles an ordinary giant marrow cell. This variety is seldom metastatic. (d) Melanoid or pigmented sarcoma—these may originate where pigment normally exists; chiefly in the skin and the eye. They are rare but when present are extremely malignant. They are composed usually of spindle cells, sometimes round cells. The pigment accumulates in the tumor from the first, is irregularly distributed, consisting of dark brown or black granules and is located in the cells, appearing first round the nuclei. In this variety there is a marked tendency to metastasis and the tumor may grow very large. (e) Chloroma—These are round celled, usually in connection with the periosteum of the face and head and there may be a secondary tumor of the same color in such organs as the liver or the kidney. The color is due to refracting granules which are apparently composed of fat. (f) Plexiform sarcoma—or as it is sometimes called cylindroma—this tumor appears in cylinders with rounded structures and having a hyaline character. In the center of which there is often a blood vessel and between which are masses of cells. It is probably due to mucous degeneration. It occurs in or about the orbit, the upper or lower jaw, the brain or its membranes, sometimes the peritoneum. (g) Aveolar sarcoma—In this variety the cells are large, usually round and arranged in spaces so that the character of the cells and their arrangement resembles a cancer.

(2) CARCINOMA OR CANCER.—This variety of malignant growth has its origin in the epithelium, has an epithelial structure; but the arrangement of the structure and its mode of growth is embryonic.

The cells of a cancer differ according to the form of epithelium from which they originate. They always grow in larger or smaller bundles or masses, forming cell nests which are very characteristic of cancer.

The stroma incloses the cell masses and supports the blood vessels. It may be simply the connective tissue of the part in which the cancer is growing or it may be a new formation.

Cancers originate in one of the three following methods: (a) The essential constituent of the tumor may be traced into direct connection with the existing epithelial structures, e. g., epithelioma of the lip. (b) It may seem to arise by direct transformation of existing epithelium, e. g., primary cancer of the kidney or cancer in the ducts of the mammary glands. (c) The epithelial elements may extend into the surrounding tissues, in fact, be an infiltration of the structures around with epithelial cells or masses of cells.

The first stage in the formation of cancer seems to be an abnormal activity of the epithelium in a particular part. As the growth and development of these cancerous masses takes place there is as a result a considerable irritation and consequently formation of round cells around the growing area.

Sometimes the growth produces a very slight irrritation and in this case the tumor may grow in normal tissue producing only symptoms of pressure.

Carcinoma may occur in any situation of the body where epithelium or even endothelium is present. Such positions as the lower lip, the tongue, the mammary glands, the uterus and the stomach are seats of preference. A preference which can be understood to a great extent by local peculiarities, e. g., the irritation of the lip or the changes taking place in the uterus and mammary glands consequent upon the changes to which the glands or the uterus may be subjected. Age, as well as sex, influences the appearance of these carcinomas. They are most frequent between 35 and 65 years.

The cancerous tumor extends by the epithelial cells penetrating into the neighboring structure and the formation of secondary tumors at a distance through the agency of the lymphatic vessels and chiefly in the lymphatic glands. Growth may take place in some cases through the blood but this condition is very rare. The secondary tumors usually appear in the liver, lungs and bone marrow. There are several different forms of cancer: (a) Epithelioma—This variety appears on surfaces covered by flat epithelium. The cells of this variety are squamous, irregularly shaped on account of the pressure to which they are subjected and may be in direct communication with the epithelium of the surface extending into the tissues in the form of a cylinder or they may exist in the tissues as masses or bodies which are known as cell nests or pearl bodies. This variety is sometimes spoken of as pearl epithelioma for that reason. Sometimes instead of the epithelial masses extending into the tissues they may project on the surface and give rise to the condition spoken of as cauliflower cancer so frequently met with in the cervix of the uterus. (b) Cylinder celled Epithelioma—This may occur wherever cylindrical epithelium may exist, the stomach, the intestine, the uterus, etc. It consists of elongated tubular structures or alveoli lined with cylindrical epithelium, in a well defined new formed stroma. It may grow to a considerable size and readily ulcerate. (c) Tubulated epithelioma—This is a more superficial and less penetrating form; occurs most frequently in the face and known as a rodent ulcer. The peculiarity of this condition is that although it may extend and destroy tissue extensively the lymphatic glands are rarely affected. The epithelial cells are of the pavement type arranged in groups.

CARCINOMA PROPER.—The most common form of this group is what is spoken of as scirrhus or hard cancer. The stroma of this variety is dense and extensive as compared with the smaller amount of cells which are present. It is frequently spoken of as more of an infiltration than a distinct tumor. It has a tendency to contract rather than enlarge the organ in which it grows. There is a marked tendency to infiltration of the surrounding structures. The cells vary greatly in size, are nucleated, sometimes multi-neucleated. It occurs most commonly in the mammary glands, sometimes in the stomach, ovary, etc.

Another variety is spoken of as soft or encephaloid cancer. This consists of delicate embryonic stroma, with small cells loosely packed in its meshes and grows usually with great rapidity. They are very liable to hemorrhage and to ulcerate. The margin of the ulcer projects in a peculiar manner and the term fungus-hematodes has been applied to the ulcerated area and the liability to hemorrhage. This variety is very malignant, occurs at an earlier period of life and is found in mucous membranes in the ovaries, testicles, etc. They are sometimes called mudullary cancers.

Cancers undergo degeneration readily and as a consequence several names have been applied indicating simply the variety of degeneration. We distinguish two principle forms of degeneration: (a) Colloid and (b) mucoid. These are sometimes spoken of as separate varieties of cancer but are only degenerations of the epithelial cells. The principal distinction between those two forms is chemical. The former not being precipitated by the addition of acids or alcohol. The latter by being precipitated in excess of acids or alcohol.

In addition to the tendency which cancers have to degenerate they also have a tendency to undergo infiltration and so we have such conditions as fatty or calcareous infiltration resulting.

DEGENERATION.—We have certain changes taking place in the tissues which alters their appearance both macroscopically and microscopically. In this condition to which we refer the cellular elements have either undergone or are undergoing a radical change interfering with the performance of their normal function. This condition differs entirely from infiltration where there is merely a deposition of foreign matter among the cellular elements of the structure but not replacing them, Degenerations are sometimes called metamorphoses on account of the radical change which takes place. There are several varieties of degeneration. (a) Parenchymatous or as it is sometimes called cloudy swelling. The protoplasm of the cell appears granular as if there had been a precipitate of albuminous material, sometimes the nucleus becomes obscured or perhaps obliterated. The outline of the cell being quite indistinct. The organ or structure affected becomes increased in size, softer in consistency and more opaque in appearance. (b) Fatty degeneration, in this condition the albuminous granular matter becomes converted into drops of oil. The nucleous becomes destroyed the cell being smaller having undergone shrinkage instead of an increase, the whole cell may lose its original characteristics and become a globule of oil. These drops remain distinct from one another and this also serves to distinguish this condition from a fatty infiltration. The structure affected becomes smaller, anæmic and greasy. Hemorrhage may be in the tissue as the result of the degeneration affecting the smaller blood vessels. (c) Colloid degeneration, in this variety the protoplasm of the cell becomes gelatinous and structureless, most occuring in connection with epithelial cells. For this reason it is mostly always associated with

glandular structures such as the thyroid, some considering it quite normal in connection with the thyroid, it is also found in connection with the ovary, and kidney. The exact nature of the material is not yet decided, chemically it is not precipitated by alcohol or acetic acid and is insoluble in water, but contains sulphur. It takes on none of the aniline stains but does the carmine. This variety of degeneration very closely resembles the hyaline variety, especially when affecting muscular tissue structures.

(d) Mucoid or Myxomatous degeneration, in which the protoplasm of the cell becomes transformed into a jelly-like substance. The part affected becomes colorless, clear and gelatinous. On careful analysis this gelatinous substance is found to consist of complex albuminous compounds with an abundance of mucin. It contains no sulphur, and is precipitated by alcohol and acetic acid. This same material is found in the umbilical cord as the jelly of Wharton and in the vitreous humor. The tissue consists of large cells with long branches which extend towards and become continous with similar branches from neighboring cells, the spaces between being filled up with this gelatinous substance. This variety of degeneration is mostly found in connection with the connective tissue structures and is therefore most frequently found associated with those simple and malignant tumors which originate in connective tissue structures. There is a general myxomatous condition spoken of as Myxœdema where the subcutaneous tissue has undergone this variety of degeneration. (e) Hyaline or vitreous degeneration. This condition resembles amyloid in appearance but differs from it in its reaction to certain chemical reagents. It also differs from it in its distribution having been found in muscle fibre, lymphatic glands and the walls of the blood vessels where it sometimes forms a complete coat. The real nature of the substance is not yet known. Some suppose that it is the result of some local action on proteid matter, others that it is due to insoluble material formed at some distant part simply carried to the place where it is found.

Many writers consider that these different forms of degeneration are simply stages of the same condition, others contend that they are separate and distinct. There is another form spoken of by some writers called Hydropic degeneration which is simply a cellular dropsy. It differs from ordinary dropsy only in this that here we have a vacuolization of the cell whereas in the other we have an infiltration of the tissues with the fluid. It is often present in cases of ordinary œdema but is not necessarily associated with or dependant upon it. The cells are soft and swollen and so also is the tissue affected.

Necrosis.—This is a condition which signifies local death of a tissue in contradistinction to general or somatic death. We have several varieties spoken of (a) Direct due to traumatism; (b) Indirect when the result of changes from within; under this division we might place those spoken of as neuropathic where the trophic nerves are at fault and senile where the changes

consequent upon adolescence produce either directly or indirectly this tendency to local death. The term necrobiosis is applied to the death of individual cells, gangrene where there is death of tissue in bulk or as it is said en masse.

The different forms recognised are (a) Liquefaction-necroses. We have this condition primary when it exists from the first in the liquid condition or secondary when it follows either some other form of necrosis or degeneration. The condition is due to the tissues becoming infiltrated with fluid and then being dissolved in the fluid. The cells may be seen in all stages of destruction until completely disintegrated. The color may be white if the fat becomes emulsified; yellow if pigment and fat are mixed; colored if blood or bile pigment is present. We may have this condition present in connection with degenerations in the central nervous system, and we find it in fluids within vesicles such as follow superficial burns.

(b) COAGULATION NECROSIS.—This condition is present in those tissues where proteid substances are present. It is somewhat allied to the formation of fibrin and also resembles to some extent hyaline degeneration. The fibrin in the tissues coagulates enclosing the cells and binding together the tissues. It is not necessary that fibrin should be present seeing that lymph containing fibrinogen may undergo the same change. It is seen in such conditions as typhoid fever, tuberculosis and diphtheria, resulting in these cases from an infection. The tissue affected is more opaque and firmer than usual, later however, it usually softens, the cells become homogenous, cease to take on stain and ultimately degenerate completely.

(c) CASEATION, OR CHEESY NECROSIS.—This condition frequently follows a liquefaction or coagulation necrosis produced by a fatty degeneration of the structure with partial liquefaction, the liquid portion being partially removed by the lymphatics leaving the curdy mass behind. It is most frequently found in connection with tuberculosis, sometimes however, non-tubercular processes may undergo caseation, and so we have at times caseous products in cavities such as the pericardium or pleura. The caseous mass frequently becomes encapsuled and this explains the hard sometimes calcareous bodies found in the tissues in the post mortem room There is no tendency to the retention of cell structure, everything undergoing degeneration.

(d) FAT NECROSIS.—This is a condition different from the true formation of fat, being in reality a disease, most frequently met with in diseased conditions of the pancreas and distributed within the abdomen and the abdominal walls. It is supposed by some to be of bacterial origin, by others to be the result of the action of the ferment of the pancreatic secretion. The areas affected are usually small, whitish in color and resemble tubercles, after a time they become infiltrated with salts of lime, some think as the result of the action of the fatty acids.

(e) GANGRENE.—This is a term which refers to the death of the soft

structures and is probably, by custom mainly, not usually considered a necro-
sis, the term necrosis being applied in this case in a more general manner. If
there be any difference of opinion in regard to the placing of gangrene in this
position it might be satisfied by saying that gangrene is necrosis with putre-
faction. We usually speak of two forms of gangrene. (a) Dry or senile
which results most frequently from an obstruction through the arterial vessels,
consequent upon the changes in the vessels associated with advanced age. It
sometimes results from causes not senile, for example in the disease spoken of
as Raynaud's disease and the effect of continued absorption into the system of
the ergot of rye. It rarely, but sometimes, follows the moist form. (b) Moist
gangrene. This variety depends upon a disturbance of the blood flow usually
a venous obstruction. It may result also from pressure, infection or trauma-
tism. The tissues affected become soft, degenerate, giving off gases and un-
undergoing changes in color. These gases given off give rise to a condition
spoken of as gangrenous emphysema. The tissues being infiltrated with these
gases. The putrefactive odor depending also upon the degeneration and for-
mation of gases. There is a variety of gangrene spoken of as hospital gan-
grene but which we might term infective gangrene. This condition has al-
most entirely disappeared owing to modern asepsis in the treatment of surgical
conditions. It was however, at one time a veritable scourge, the wounds be-
coming affected, the margins degenerating and the tissues becoming destroyed
very rapidly. It usually terminated fatally.

INFILTRATION.

This condition differs from that form which we considered under the
term degeneration. Here we have something additional in the structure or
tissue of the organ affected. Under degeneration we found that the cells them-
selves became involved, in fact replaced by a new tissue, whereas in this con-
dition we have something superadded, thrown in as it were between the cells.
The former condition we speak of as tissue formation, the latter, infiltration of
material or substance.

We recognize several varieties of this condition. (a) Fatty Infiltration.
In this variety we have the deposition of fat either in excess of the normal or
in structures where none normally exists. We have this condition exemplified
in the fatty infiltration of the liver, where we find around the periphery of the
lobule, between the liver substance proper, masses of fat globules or cells;
it is also seen in the muscular tissue in that form of paralysis spoken of as
pseudo-hypertrophic. In regard to the origin of this fat we may consider two
sources, either a physiological excess of fat production, or a pathological con-
dition in which absorption is deficient. On examination of the tissues affected
the fat may appear either localized, or diffused in the tissue, the tissue rarely
taking part in the process. The cells of the structure may, however, be infil-
trated, although it is most usually found in the connective tissue structures.

(b) ALBUMINOID INFILTRATION.—Here we have albuminoid or amyloid material infiltrated into such structures as the blood vessels, liver, spleen, mucous membranes and lymphatic glands. In the spleen the Malpighian bodies are involved, showing out distinctly and resembling sago, hence term "sago spleen." Many consider this condition simply a degeneration, in a great many cases probably the condition is a degeneration, but where we have an infiltration into such an organ as the liver and perhaps doubling its weight, we can scarcely do otherwise than recognize a difference between degeneration and infiltration. The organ affected becomes pale, large and heavy with rounded margins. Chemically this substance is recognized as described under amyloid degeneration.

(c) PIGMENTATION.—This consists of the introduction into the tissues of pigment granules. Usually we speak of pigmentation under two different divisions. (1) From without the organism, in this group we include those solid pigments carried into the tissue. We have such cases as anthracosis, where solid particles of coal become deposited in the lungs, and to a lesser degree particles of carbon similarly deposited in the lungs through the lymphatic system. We have also particles of iron, stone or chalk deposited in the lungs of those whose employment requires them to be associated with these minerals in their broken up condition. (2) From within the organism as the result of changes in elements normally present. We have a condition spoken of as hematogenous pigmentation which refers to pigments depending upon, or derived from the hemaglobin. Normally hemaglobin gives no color to any tissue with which it comes in contact, but in certain diseased conditions the coloring matter may be altered or pass off through the excretions as in hemaglobinuria. Melanine, a pigment normally present in the skin of the negro and the areola of the mammary gland, is sometimes seen in diseased conditions as in melanotic tumors, Addison's disease and malarial fevers where it is present in the spleen and liver. We have another condition which is spoken of as hepatogenous pigmentation, which is produced indirectly from the blood as a result of metabolism, being derived directly from the hepatic secretion, this is what is called jaundice. The only tissue of the body which seems to be free from this form of pigmentation is the cerebral substance and even this in new-born children may be affected. Another form is spoken of as metabolic pigmentation, which is the result of the cellular activity in the organism. We have such local conditions as chloasma, or coloration of the skin generally during pregnancy and the cachexia which is characteristic in carcinomatous conditions. Pigmentation depends sometimes upon bacterial growth and is seen in catarrhal discharges from mucous surfaces.

(d) CALCAREOUS INFILTRATION.—Here there is deposition of the salts of lime and magnesium in the tissues, this is best seen in the walls of the blood vessels in adolesence, as the result, some claim, of the tissues having less solvent

power over the salts, or as others claim, by the changing of the soluble into the insoluble salts, probably on account of the salts being deposited as insoluble combinations with proteids. Sometimes the calcified portion appears in nodules or plates, very rarely as crystals. It is one of natures methods of limitation to the inroads of infections diseases, tubercular and actinomycotic masses being encircled by it.

(e) GLYCOGENIC INFILTRATION.—Glycogen resembles amyloid material giving the same reaction with iodine, but refusing to act like the amyloid material with iodine and sulphuric acid; it is also very soluble in water, whereas the amyloid is insoluble. It is frequently met with as an infiltration in the epithelial cells of the loop of Henle in the kidney, in leucocytes, in pus cells and in certain of the tumors. On account of its presence in the leucocyte it is claimed that diabetes can be diagnosed before the sugar appears in the urine. Organs affected become pale, enlarged and moderately heavy, less brittle than the amyloid and having low specific gravity.

(f) Some think an infiltration of cholestrine sometimes takes place, it is present at times whether as a degeneration or an infiltration would be difficult to determine. It is present within cysts and inflammatory exudations. It is distinguished by its characteristic appearance with the microscope, appearing as thin rhombic plates with a small square cut out of the corner.

(g) Uric acid and its salts in gouty conditions are frequently deposited around the joints, also in the skin, kidneys and fibrous tissue generally. Associated with this deposition there is nearly always degenerative changes, sometimes even necrosis. It is due to defective excretion, faulty oxidation or overproduction.

CIRCULATORY DISTURBANCES.

The circulation of the blood is usually supposed in normal conditions to take place through the vascular channels as the result of the contractions of the heart, the elasticity of the arteries, the contraction of the muscles of the body acting on the veins with the assistance of their valves and the suction of the movements of the thorax, but it is also aided by the quality of the blood itself. For that reason we consider the changes which take place in the blood. We have such conditions as: 1. Anæmia where we may have an interference in the amount of blood to a part, which would be local anæmia, or changes due to the quality of the blood, which would be general anæmia. In the former condition, which is sometimes called ischemia, the area affected becomes pale and bloodless, sometimes associated with more or less œdema, and if the process has been developed slowly degeneration usually follows. In some cases where local anæmia has developed rapidly, as in the ligation of an artery, death of the part may develop. In the latter, changes take place in the tissues consequent upon the interference with the nutrition, so that we have impairment of function and more or less degeneration of the organs and tissues of the body as a whole.

2. HYPERAEMIA.—Here also we may have two conditions, either a general hyperaemia in which there is an abnormal supply of blood in the body, or local hyperaemia where there is an increase only in a part of the body. In the former we have what is spoken of as true plethora, where the corpuscular portion is increased, or hydremic plethora, where the watery portion is in excess. General plethora may be due to an overproduction of blood, or diminished metabolism. In the latter we have two varieties, an active hyperaemia or congestion and a passage hyperaemia. In the first of these varieties we have an increase in the caliber of the arteries of the part as the result of vaso-motor or local affections. The part affected becomes red in color, swollen and loses its function—ordinary symptoms of inflammation. In the other variety the condition depends upon an obstruction to the blood from a part, retarding its onward flow towards the heart. This may result from local pressure or impaired action of the heart. The part becomes bluish in color, somewhat cold to the touch and swollen on account of the exudation of the fluid part of the blood into the tissues, with or without the cellular elements. There is a form of hyperaemia associated with weakness of the heart and tissues where the dependent part becomes congested, this is hypostatic congestion, seen in the lungs of typhoid fever patients when the disease is of long duration. A condition spoken of as anhydremia where the quanity of fluid in the blood is diminished, this is seen in cholera, but the fluid need not be removed from the body, simply becoming extra vascular.

Sometimes the red blood cell migrates from the vessel to the tissues surrounding the vessel, in such cases as maligant œdema, anthrax, and active hyperaemia, this condition is known as rhexis

3. OEDEMA.—In this condition there is an excess of fluid in the tissues. Accumulations of fluid in the abdominal cavity may be spoken of as œdema, seeing that the serous cavities are usually looked upon as lymph spaces, in this way we have a broader basis of classification and at the same time making these conditions more easily understood. The tissue affected becomes soft, pale, less resistent to injury or disease and readily pits on pressure, sometimes undergoing some form of degeneration. It is the result of some deficiency in the blood, the blood-pressure or in the walls of the vessels. It is frequently spoken of according to the cause producing it, e. g., infectious, neuropathic or traumatic.

4. ECCHYMOSIS.—This means an actual hemorrhage into the tissue. It appears as a bluish spot following an injury, the color changing as the result of oxidation. Very small spots are spoken of as petechia, these are seen in such blood diseases as scurvy and are found on both the skin and mucous membrane.

5. THROMBOSIS.—This is a coagulation of blood somewhere within the vascular channels in life. Post-mortem clots are free, smooth and glistening

in appearance. According to Cohnheim the thrombus easily splits into layers in a longitudinal direction and that along with their attachment is sufficient to distinguish the two conditions. There are several forms of thrombi, the white which contains only leucocytes the red which contains coloring matter and red cells, the stratified which is formed in layers, as in an aneurysmal sac, the gray which is a mixture of the white and red varieties all of which contain fibrin as the essential of coagulation. Other terms are used, such as, primary, secondary, simple or infective. Thrombosis results from alterations in the blood, from alterations in the current of the blood and alterations in the walls of the blood vessels. Thrombi may degenerate, break down and become dislodged forming emboli (see under embolism). They may remain adherent, become decolorized, undergo resolution, become organized or undergo calcification, in this latter manner phleboliths or vein-stones are formed.

6. EMBOLISM.—When any solid body is carried through the circulation it is known as an embolus. These emboli may be broken down or dislodged thrombi, portions from the valves of the heart, foreign bodies, parasites or portions of tumors. Emboli are usually found in the general arterial system, there is a form of embolus arising in the venous system, passing through a defective septum in the heart, which is called paradoxic or crossed embolus, and sometimes recurrent or retrograde embolism, where alteration of pressure allows a backward flow of the blood stream, allowing this condition to take place. As the result of these emboli we may have cerebral hemorrhage from occlusion of vessels, or the condition that is spoken of as infarction. An infarction results from the obstruction of the vessel by one of these emboli, the vessel being terminal usually. In that case where the vessel is terminal, from the point of obstruction outwards forming a more or less pyramidal area, there is a complete loss of circulating blood. As a result of this loss of circulation there is a complete stagnation, involving the artery and its branches, the capillaries and the veins corresponding to the artery involved. The area affected may undergo coagulation, may soften and degenerate or become infected even in non-infective cases. Infective emboli produce metastatic abscesses, if tubercular or sarcomatous they produce secondary tuberculosis or sarcomatous growths.

The most common foreign bodies producing emboli are air, fat and sometimes dust. If air or fat be present in any quantity the result is nearly always sudden death.

BACTERIOLOGY.

The progress in the line of a more accurate diagnosis of diseases has been very much aided by the better knowledge of the causation of these conditions. Perhaps nothing has assisted so much in this as the study of this branch of science the knowledge of which has given us such an insight into the many hitherto obscure or unknown agencies at work resulting in disease or per-

haps even death. It may be that the study of this branch has led to a more active consideration of disease in general so that indirectly as well as directly modern scientific developement has been of service to humanity and the world. It behoves us to take advantage of all that may lead us to a more accurate comprehension of and at the same time be the better equipped for combating all forms of diseases to which mankind is heir.

These lowly forms of living germs which are found in or upon the body are spoken of as micro-organisms. Some consider them to belong to the animal kingdom, others to the vegetable, their being still others who claim that they belong to and ought to be placed in a special group by themselves. It is probable that the latter view is the more correct although it would not be justiable to say so in a dogmatic or absolute manner. Micro-organisms are generally classified as follows:

(1)   Bacteria—fission fungi—Schizomycetes.
(2)   Yeasts—yeast fungi—Saccharomycetes.
(3)   Moulds—mould fungi—Hyphomycetes.

The group which concerns us most is the first. To it belongs those which cause the various serious diseases, the other two groups taking a very subordinate part in the production of disease. The micro-organisms are quite colorless being entirely devoid of chlorophyl. They are very small, so small in fact as to be almost unseen with the greatest of amplification of microscopic lenses. On account of their minuteness there is little known in regard to their structure, some claim however that a nucleus can be found and that the protoplasm is granular or it may be vacuolated, it seems hardly possible to substantiate this on account of the more or less imperfection in optical appliances, at the same time granting that great progress has been made along that line and the possibility, even probability, that further progress will result in the substantiation of all these claims.

Bacteria differ in their appearance this difference being taken as the basis of a classification. We have (1) Cocci which are spherical or oval in shape; (2) Bacilli which are rod shaped; and (3) Spirilla which are curved or spiral. Bacteria develop with great rapidity, Buchner claims that under favorable circumstances a simple reproduction takes place in from 15 to 40 minutes, so that by accurate calculation we may have as much as 16,000,000 produced in twenty-four hours from a single bacterium. They reproduce themselves in two different ways (a) by simple division where the cell undergoes an elongation process and then divides, the cells remaining in contact or else separating immediately, or (b) by spore formation There are two different varieties of this latter (a) Endogenic where the spore forms within the cell membrane, or (b) Arthrogenic where there is the formation of the spore external as compared with the latter. In the former a single differentiated spot appears in the protoplasm of the cell, in the latter the cell itself takes on characteristics of a

spore which seems to be a resistance to the tendencies to destruction. It is a rare condition being seen only in the cocci. the former is much more common particularly among the bacilli, rarely, among the spirilla.

In order that growth and developement may take place certain conditions and materials must be present. Carbon, hydrogen, oxygen, nitrogen and certian mineral salts such as sulphur must be present, these can be derived from the albuminoids and carbohydrates. Many can do without the presence of oxygen these are called anaerobic as compared with those which require its presence and are called aerobic. Some can grow less vigorously however without it although they are properly aerobic these are called facultative aerobes, or reversing the conditions, anaerobic bacteria may grow to some extent in the presence of oxygen these are facultative anaerobics. The term obligate aerobe is applied to those which must have oxygen, obligate anaerobe to those which grow only without it. Moisture is also requisite although its absence may not mean death but simply a suspension of vitality. The temperature of the normal body is the best yet some live in as low a temperature as —100 ° C, others thriving at 60 to 75 ° C. The bacteria themselves are usually destroyed by a prolonged exposure to a temperature of 100 ° C, particularly if moist. The spores are more difficult to destroy and in order to do so require an exposure of short periods for three or four successive days. Some have been heated dry to 140 ° C and still continued to live. Light retards their growth and in many cases kills them altogether.

We must not suppose that these bacteria are present in the world simply for the purpose of embarassing mankind, for were it not for their existence and activity the essential elements of life (C. H. O. N.) would all remain in some combination in the material world and all life would necessarily cease to be, but as they live the elements are set free, as organic matter becomes decomposed. We have as the result of their activity substances known as enzymes, or soluble ferments elaborated, which play a very important part in the process of digestion.

It is necessary to keep in view the fact that some bacteria may be found under ordinary circumstances on the mucous surfaces as well as the cutaneous, and this raises the question of the natural protection against the inroads of these germs. We must reckon among the natural agencies giving protection, the skin while intact, the epithelium covering the mucous surfaces assisted by the activity of the cilia which cover it, the natural protection of many of the mucous surfaces on account of their anatomical relations, the filtering process the fluids undergo while passing through the lymphatic channels, together with the inherent power in certain cells and fluids to destroy the bacteria as they enter.

There are two great groups into which these bacteria are divided depending upon the peculiarity of the particular micro-organism. There are the

Saprophytic which live upon the waste products or food substances of the body without producing any pathological changes; and the Pathogenic which directly produce disease with general symptoms and local manifestations. The term Pathogenic is a relative one seeing that we may have germs which are pathogenic in some forms of animal life non-pathogenic in others, and further that the virulence may be modified by cultivation. In order that a germ may be truly considered pathogenic Koch insists on the fulfillment of these requirements: (1) The organism must be present in all cases of the disease. (2) It must be cultivated as a pure culture from that disease. (3) It must produce the same disease in susceptible animals after innoculation. (4) From such animals the germs must be obtained and re-cultivated. Another condition has lately been added that from the cultures a toxin should be separated capable of giving rise to the same set of symptoms

In order to comply with these requirements innoculation and cultivation become necessary. Innoculation means the conveying of the material experimented with to the tissue of some animal susceptible. There are five different methods of innoculation usually considered: (1) Subcutaneous—the tissue is placed directly under the skin; (2) Injection into the peritoneal cavity with a syringe; (3) Directly into a vein usually in the ear; (4) Into the anterior chamber of the eye; (5) Transplantation of tissue as in tuberculosis. After death fluid is removed from the chambers of the heart and important organs and cultivated, or tissues are removed and prepared for microscopic examination. Every part of the process is carried on under the most rigid aseptic precautions.

To make cultivations certain media are required, those most commonly used being blood serum, milk, egg albumen, eggs or potatoes. The blood serum is the more valuable. It can be obtained by collecting fresh blood, allowing it to coagulate and running it off with a syphon, placing it upon ice to make it clear by precipitation. It is sterilized by heating it one hour daily for four days not above 65 ° C, then raising the temperature gradually in order to get coagulation, if that is wanted, up to about 70 ° C. If heated too high the coagulation may resemble egg-albumen and although that does not seem to interfere with the result of the culture yet the appearance is not so good and perhaps the result may be better. It is necessary to have all the different appliances which are used in the process of cultivation perfectly sterile, this is done by washing the glass tubes, plates and rods, then placing them in a sterilizer for a few hours, if they have been used before it is better to wash them in a 1 per cent Hydrochloric acid solution.

In order to get a pure culture it is necessary to take the mixed culture with which we almost always have to deal and put it through a process of separation. A pure culture means that there is only one germ in the culture media. The process above referred to is briefly this, take three tubes with a

sterile culture media, innoculate tube 1 with the mixed material, then from this tube innoculate tube 2 and from this second tube innoculate tube 3, each being thoroughly mixed up before doing so. Then pour the contents of tube 1 into a flat plate, the contents of tube 2 into another, and the contents of tube 3 into another, number each plate carefully and wait for the growth of the colonies. The separate colonies are different varieties of bacteria. Select a colony which is well isolated and innoculate through a series of tubes as before repeating the process until a perfectly pure culture is obtained. There are three different methods of innoculating the tubes, (1) the infected needle is simply rubbed over the surface; (2) drawn over the surface; or (3) stuck right down into the culture media, this later being used most frequently—always in gelatine cultures.

The bacteria as the result of their activity elaborate certain products which we must consider. A Ptomain is a putrefactive animal alkaloid formed as the result of the activity of the bacteria in organic matter. They contain nitrogen and resemble vegetable alkaloids. They are formed by the putrefaction of albumen and the formation first of peptones and of bodies similar to them, after that this particular substance. Certain bacteria give rise to ptomains which induce serious effects in many infectious diseases, these are called toxins. In other words a toxin is a poisonous ptomain. A Toxalbumen is a poisonous soluble albuminous substance produced by the activity of bacteria in the presence of albumen. They differ from ptomains in being soluble in water and being precipitated on the addition of alcohol. The active principle in Koch's Tuberculin is a toxalbumen. The constitutional symptoms of disease are due to tox-albumens.

The recognition of bacteria depends to a great extent on the way that certain vegetable dyes act upon them. The aniline dyes—products of coal-tar—are most frequently used. Eosin is also used as a counter stain, that is a comparison stain, so that the outline of the micro-organisms may appear distinctly among the other structures. Further than this a microscope with high power of amplification, (at least 600 diameters) is required, we use 1-12 or 1-16 of an inch objective with an oil-immersion and an Abbet's condenser, which concentrates the rays of light.

TUBERCULOSIS.

Tuberculosis is a disease which is nearly always found in the human family, in a few rare instances it is found among the lower animals, and then in the warm blooded only. It is a disease which depends upon the bacillus of tuberculosis and the condition resulting, depending upon the activity of the germ producing the particular pathological tissue spoken of as tubercular. The principal feature in this tubercular tissue is the small nodule or as it is called "tubercle" which is characteristic of the new growth. There are two different varieties of these tubercules (1) the gray or white which con-

sists of a zone of ordinary round cells, the result of irritation, within there is an area of epitheliod cells and still nearer the center, in fact in the center, of this nodule the giant cell so characteristic of tuberculosis. This variety is smaller and firmer than the other, it is considered by many to be the early stage of the (2) which is larger and softer, at the same time yellow in color, the result probably of the degeneration of the white as a consequence of the presence and activity of the bacillus.

The bacillus is rod shaped, either curved or perfectly straight, and with rounded ends. They may be present in greater or less quantities, approximated to one another so as to form chains, or quite separate from one another. They are about one-third of the diameter of a red blood cell in length, in other words, three or these bacilli can lie end to end upon the red blood cell. When stained they appear as if the protoplasm was beaded, this is due to the irregularity of the protoplasm, and not as some have thought to the formation of spores, seeing that there is no spore formation demonstratable, at least so far as investigations by the more modern bacteriologists have gone. They reproduce themselves by fission, thrive best at the normal temperature of the body in the dark, are facultative aerobes and may be cultivated on several culture media, although in all cases they grow slowly. Sunlight and a moderately high, moist temperature soon kills them. They may resist dry heat for a reasonable time in fact may not be influenced by it at all.

This disease may become established in the body in several ways (1) by inoculation through some abrasion of the surface; for example the post mortem wart; (2) aerial infection as the result of the immense quantities of these germs floating constantly in the air. (3) dietary infection depending upon the want of proper isolation of those suffering from the disease and the part they take in the production of the different articles of diet, and to the natural articles, such as milk which contains the germ as a consequence of the animal being affected from which the milk was taken; (4) any condition tending to lower the vitality of the tissue or the organ. This includes the other ones just mentioned at the same time that it makes it possible for us to group the sources of the origin of this very intractible disease. We have the question of heredity to consider. In regard to the question as a whole just let us say that the only part that heredity takes in the process is simply this, that there is the inheritance of a peculiarity of soil or of tissue upon which the bacillus readily grows, but the germ itself is never transmitted only planted. In addition to the problem of the establishing of the disease we still have to consider the various ways by which the germs spread themselves through the body. A tubercle may break down and in doing so may open into a vein, so that it may be carried by the blood stream and if so it is usually general; or it may be that the germ is tak-

en up by the lymphatic glands as the material passes through the lymphatics from some surface, for example, the mucous membrane of the mouth or throat; or it may be either by continuity of structure, as in tuberculosis of the ureter following a primary tuberculosis of the bladder, or contiguity of structure as in tuberculosis of the meninges of the brain following a primary tuberculosis of the middle ear.

There are several terms in common use in connection with these tuber-cular conditions, we have frequently to meet with what is spoken of as mili-ary tuberculosis which signifies that we have a general distribution of small tubercles throughout the body or the structure involved. Again there is what is spoken of as quiescent tubercle where the tubercle has beeen en-capsuled, the contents becoming more or less absorbed leaving a caseous mass behind, sometimes these tubercles break down and form a new source of infection. The term secondary infection is applied to those cases where there is the entrance of pyogenic bacteria and the formation of abscesses.

The most common sites for the tubercular condition in the child are the lymphatic glands and the bones, whereas in the adult by far the most fre-quent location is the lung. This fact alone seems to afford one of the most definite proofs that there is no such thing as heriditary tuberculosis, if there could be heredity we would expect at least that the same structures would be affected.

TUBERCULOSIS OF THE LYMPHATIC GLANDS OR AS IT IS FREQUENTLY CALLED SCROFULA. We may have any of the lymphatic glands of the body affected, but the cervical, the peribronchial, the intestinal and the messen-teric are the most frequently involved. The source of infection in these cases evidently being the mucous surfaces. The gland affected becomes en-larged, soft and what is of greater importance, there is no attachment to the structures around. It is surrounded by a very thin capsule, within which may be found tubercles in different stages of degeneration. The capsule may be become thicker and the gland more or less fibroid when we have the condition already referred to as quiescent tubercle. This very frequently takes place in connection with glands and it would be fortunate indeed if it could be said that it had the tendency to remain, but as it is not so we must consider what does take place. The connective tissue surrounding the gland becomes inflamed, a peri-adenitis follows and the caseating gland becomes adherent. The gland breaks down, a tubercular abscess forms and soon becomes infected by pyogenic bacteria with general systemic phenomena following. In the most of the cases of glandular involvement individual glands are affected, in a very few cases do we have a general or disseminated condition.

(2) TUBERCULOSIS OF BONE. This condition is most frequently at the epiphysial line, occasionally in the cancellous tissue. It is looked upon as

being the result of an infarction produced by the bacilli as they are carried through the vascular channels. When the disease is at the epiphysis it is limited but in the cancellous tissue it is disseminated so that the whole of the bone may be necrosed. The periosteum readily gives way and the parts around become involved setting up an abscess, a condition associated with tuberculosis of the vertebra, this explains the reason why in tubercular patients a slight injury results in an abscess.

(3) TUBERCULOSIS OF JOINTS. This is frequently as an extension from bone, but it may be from cartilage, synovial membrane or ligament. The structures around the joint undergo a softening process and in this pulpy tissue lie the tubercles in different degrees of transformation.

(4) TUBERCULOSIS OF LUNG. We have three different varieties affecting the lung (a) acute miliary phthisis; (b) caseous phthisis; (c) fibroid phthisis. In the miliary form we usually have a general infection taking place through the blood or the lymph stream, although it is common enough to have the lung most affected, or we may have the germs entering the lungs during the respiratory process. It is mostly the circulatory infection which starts up this condition, and as the result of the infection we have more or less of the tissue of the lung involved in an inflammatory process filling up the alveoli with the products of the inflammation, setting up an attack of what has been called acute pneumonic phthisis. The tubercles are small, distributed freely in the tissue and undergo similar changes to those already described. In the second form the infection takes place through the air passages. Some claim that we always have a preliminary broncho-pneumonia, others that a broncho-pneumonia follows, the desposition of bacilli in the air passages. Whatever theory be correct, we have at least the symptoms of a catarrhal or broncho-pneumonia along with the tubercular affection, so much is this the case that some speak of a tubercular pneumonia. In the inflammation products the tubercles appear and as the result we have a caseation taking place, instead of resolution which usually takes place in the simple forms of pneumonia. These tubercles may be limited in number and widely separated from another or they may be grouped together, these groups readily run together forming what is spoken of as confluent tubercles. These confluent tubercles on account of the necrosis and obliterative changes in the vessels break down and form tubercular abscesses perforating the wall of a bronchus. in this way the debris being expectobated. In this way we have formation of cavities. These pathological changes, referred to, explain the reason for different names applied to the condition, such as caseous or ulcerative phthisis. The walls of these cavities consist of two well marked zones, an inner or degenerative with tubercles in all stages and an outer principally of granulation tissue, but containing also tubercles. It is mostly after the abscess has ruptured that secondary or pyogenic infection takes place so that we have in those tubercular cases only tuberlar

symptoms up to a certain point, after that, we have pyaemic systoms superadded.

In the tubercular condition there is sometimes a tendency to repair instead of the usual tendency to caseation and necrosis so that we have a development of fibrous tissue. When the infection is limited and the fibrous changes well marked we have the third variety of tuberculosis, what is spoken of as fibroid phthisis. The lung becomes hard and fibrous depending on the amount and distribution of the new formed fibrous tissue, the tubercles are more or less encapsuled, consequently the disease is practically chronic.

(5) TUBERCULOSIS OF SEROUS MEMBRANE. We have this condition presenting iteelf in two different varieties (a) where we have the sero-fibrinous exudation as the result of an inflammatory process with tubercles distributed throughout the fibrinous deposit, or (b) we may have simply the tubercles situated in the tissue this latter we find very frequently in cases of tubercular peritonitis, the tubercles being readily recognized by the naked eye. The tubercle is of the miliary type usually undergoing necrotic changes as already indicated.

(6) TUBERCULOSIS OF SEROUS MEMBRANE We have already referred to this condition in the variety of phthisis spoken of as caseous, we may have, however, tuberculosis of mucous membrane other than that of the mucous membrane of the lungs. The mucous membrane involved becomes infected by the tubercular germs passing over it, typical tubercles develop, these caseate and run together, or run together and undergo caseation, break down and discharge so that we have a condition of ulceration present, this is well seen where the intestine is involved.

(7) TUBERCULOSIS OF THE SKIN. The most common form is what is spoken of as lupus, where we have small vascular nodules appearing with tubercles in their substance. These tubercles may enlarge, run together and ultimately ulcerate that condition is spoken of as lupus excedens, or they may come off in scales leaving a smooth white scar behind and spoken of as lupus non-excedens.

We have three bacilli which resemble the tubercle bacillus. Before considering the methods of recognizing the latter we will refer briefly to the diseases with which the former are associated.

(1) SYPHILIS. The bacillus of Lustgarten has been found in connection with this disease and has been by some supposed to be the cause of it. Although the symptoms of the disease point to a microbic origin yet it would scarcely be fair to state it was produced by this particular micro-organism. The germs have been found in the Syphilitic secretions and lesions, they are straight or somewhat curved with a slight bulging at the ends—to this extent differing from the bacillus of tuberculosis—are with difficulty cultivated and reproduced themselves by fission, probably also by spore formation.

Syphilis is either hereditary or acquired. In the former the infection may be from either parent, the result of a diseased condition of longer or shorter duration, the latter by sexual congress, sometimes accidentally as in obstetric or surgical practice. It may be transmitted by vaccine taken from a syphilitic subject.

The initial lesion is spoken of as a chancre and may appear in the skin or mucous membrane. It may present itself in one of three forms, either (1) the skin peels off and a purplish spot appears without any induration or ulceration, or (2) there may be an indurated area underneath the skin, or (3) a well marked, elevated and indurated patch appears, which ulcerates readily and bleeds freely, the discharge being watery, this is the true or Hunterian chancre. The chancre is the new tissue formed by the activity of the poison or the virus undergoing necrosis or degeneration, surrounding this there is an area of round-cell infiltration, with some epitheloid cells among them and occasionally even giant cells. This chancre—for it is usually single—may undergo ulceration and the glands become affected or the glands may be affected without ulceration those glands nearer to the seat of infection being most frequently involved. If at the time induration appears in the original lesion, we have what is referred to as the bubo of syphilis. When the infection is mixed, that is to say, partly syphilitic and partly purulent, the initial lesion appears early, remains soft for a length of time and may be either multiple to begin with or become multiple This is the soft chancre or chancroid of the different writers.

The different manifestations of the syphilitic condition are so characteristic that they are spoken of as primary, secondary and tertiary. The primary are those already referred to as the initial lesion and the syphilitic bubo. In regard to the bubo it should be noted further that the gland simply undergoes an increase in its size or hyperplasia, as a rule, if the patient be tubercular or the chancre become infected with pyogenic micro-organisms then the gland or bubo undergoes suppuration. In a few—5 or 6—weeks after the appearance of the bubo the lymphatic glands of the body generally become enlarged, there are constitutional symptoms with marked rise of temperature the result probably of the absoption of the toxins elaborated by the activity of the micro-organisms, and following this a fall in the temperature and the breaking out of the typical syphilitic eruption. This stage is spoken of as general syphilis but is simply the passing from the primary to the secondary stage.

The secondary stage is characterised by lesions of the skin, the mucous membrane and the bones. The lesions of the skin are eruptions of some form or another—the so called syphilides—and these may simulate any of the ordinary skin eruptions although not being absolutely similar to them. They differ in that the margins are abrupt and the color somewhat resembling copper. Further than this they are chiefly found on the chest, abdomen, back, neck or

forehead, rarely on the face or hands, and they are nearly always poly-morphous, that is, different forms are present at the same time on the same individual. These eruptions may be simply an erythema. the pathological condition being a hyperaemia; papular, where there is an infiltration of cells; pustular, the formation of pus; tubercular, the formation of small nodules of granulation tissue; pigmentary, deposition of coloring matter; or purpuric where there is exudation of blood. In addition to the eruptions on the skin there are the allied affections of the hair and the nails. The hair dies and falls out on account of the degeneration of the hair-bulb. The matrix of the nail becomes inflamed, the skin at the edge of the nail ulcerates and the diseased nail comes off, another nail grows, but it is diseased also because of the disease of the matrix. The lesions of the mucous membranes are mucous patches, warts or condylomata, the two latter being modifications of the former. The mucous patches are superficial, painless ulcers, appearing on any mucous surface, they correspond to the papular eruption on the skin. They are papules on the mucous membrane but are devoid of epithelium and are consequently moist If the papillae on this patch become hypertrophied and stick together they form condylomata, should the papillae be hypertrophied but remain apart they form the wart. These patches are nearly always present during the secondary stage on some part of the mucous membrane. The lesions of bone are localized inflammations of the periosteum. These inflammations give rise to the formation of nodes which may remain soft or undergo calcification when they are hard. Those most commonly affected being the cranial bones the tibia and the clavicle.

The tertiary stage is characterized by the formation of gummata, these consist of masses of round cells, epitheloid cells, sometimes giant cells and a very small amount of intercellular material. The blood supply being cut off the nutrition is impaired, necrosis follows and the mass becomes caseous. The caseous parts are opaque, have fine granules and degenerating cells with nuclei in them. If gummata are located near a surface ulceration takes place, the ulcers being serpiginious, the edges undermined. These gummata are met with in almost any tissue in the body, skin, mucous membrane, muscle, periosteum, arteries and the internal organs. In the organs the gummata may remain within its substance or may be evacuated.

In hereditary syphilis the lesions are chiefly inflammatory affecting the skin and mucous membrane, the characteristic lesion being the peculiar form of teeth spoken of as Hutchinson's teeth.

(2) LEPROSY.—The bacillus of leprosy exists in the leprous lesions. They are small, rod shaped and very like the bacillus of tuberculosis. They are non-motile, very difficult to cultivate, but have been cultivated on blood serum and reproduce themselves by fission, or it may be also, by spore formation. They are regarded as the specfic cause of the disease. The disease

seems to be more frequently found in certain countries but may be distributed throughout any locality. The disease exists in two different forms. (a) Tubercular Leprosy which affects the skin or the mucous membrane. These tubercles may be present in any part of the body with the exception of the scalp, they are variable in size and distribution, the color being somewhat irregular, usually dark. The tubercle consists of granulation tissue, the cells of which are variable in size and shape, usually always containing the bacillus of leprosy. Necrosis readily takes place, ulceration follows frequently and the wound becomes infected with pyogenic micro-organisms. The ulcers either heal or by extension produce marked deformity. The tubercles may be arranged in groups giving rise to the characteristic grape-like masses sometimes seen on the face or they may be simply diffused over the skin or the mucous membrane, sometimes in some of the viscera. (b) Anaesthetic Leprosy which affects principally the nervous structures. The nerve affected becomes swollen, granulation tissue becomes developed giving rise to localized enlargements of greater or less extent. As the result of these swellings and the changes to which they are subject, the nerve fiber becomes compressed and its function lost, so that we have, if one of the larger nerves be involved, areas of anaesthesia and sometimes even destruction of hair-bulbs or sweat glands. Sometimes the condition extends so as to involve the central nervous system, giving rise to an oedematous condition, or it may be an effusion into the ventricles and under the membranes.

(3) THE SMEGMA BACILLUS—This bacillus resembles the other forms of bacilli already referred to in appearance. It is distinguished from them by its reaction to the staining reagents. It is usually found underneath the prepuce, and does seem to have much pathological significance.

STAINING THE TUBERCULAR BACILLUS. In order to study the germs and at the same time be able to recognize them, it becomes necessary to color them in order that they may be the more easily seen. In doing so we require to remember that they exist in the fluids of the body as well as the tissues and consequently we have to examine for them in the liquid as well as in the solid medium. In the examination in the liquid state, for example sputum, we search for particles floating in the sputum, take one of these, place it on a sterilized cover glass—the cover glass is sterilized by passing through the flame of a Bunsen burner—spread it carefully so as to form a film, this film is dried by exposure to the air or by passing over a flame. It is then ready to stain, except that we usually pass it through a flame to coagulate the albumen and fix the specimen. There are several stains available, but the one most satisfactory perhaps, is the Ziehl's carbol-fuchsin solution, principally because the same stain is applicable in the solid condition as well as in the liquid. The specimen is carefully covered by the staining solution, then heated but not allowed to dry or boil, for about three minutes, over a gas jet.

The excess of the stain is removed by washing in water, then placing the specimen in a 5 per cent sulphuric acid solution until the color has practically disappeared, then using a counter stain, such as methylene-blue, for the purpose of contrasting the micro-organisms which have been stained red with the other tissues around, which would appear blue. The specimen is then washed, mounted and examined. In order to examine specimens of tissue the unstained tissues are cut into sections, one of these sections being placed on a cover glass and fixed there by some fixative agent, such as the albumen fixative, the process of staining being similar from that point, to that above referred to. After the staining process, before mounting, the specimen requires to be cleared by the application of the oil of cloves, and is then mounted in balsam.

These bacilli are distinguished from the bacilli already referred to in the following way, (1) The bacillus of Lustgarten differs from that of tuberculosis in this respect, that it becomes entirely decolorized by the sulphuric acid solution. (2) The bacillus of leprosy is distinguished by a somewhat different process in staining, by what amounts, in fact, to a greater resistence to a bleaching of the stain. If stained for a few minutes in a dilute alcoholic solution of fuchsin, then cleared in a solution of nitric acid in alcohol, the leprosy bacillus remains red, the tubercle bacillus is decolorized. (3) The smegma bacillus when stained with Ziehl's solution, then placed in alcohol becomes bleached, the tubercle bacillus does not.

Ziehl's solution is prepared as follows: Fuchsin one gramme, alcohol 10 c. c.; dissolve 5 gms. crystaline carbolic acid in 100 c. c. of water then mix the two solutions. It is then ready for use.

PNEUMONIA.

The term pneumonia is applied to all the forms of inflammation of the lung tissue. There are three principal forms usually referred to:

(1) Lobar, Croupous, or Fibrinous Pneumonia.

(2) Catarrhal, Lobular, or Broncho-pneumonia.

(3) Chronic, Fibroid, or Interstitial Pneumonia.

We do not intend to convey the idea that these are the only forms of pneumonia which exist, simply that these are the more common.

1. This variety is frequently spoken of as lung fever, a term which may not be altogether inappropriate. It may even be called pneumonitis signifying an inflammation of the lung tissue. The term lobar is applied to it because either one or more lobes are affected; croupous on account of the similarity of the histological changes to that of croup.

It is generally now looked upon as being the result of a specific micro-organism—the Diplococcus pneumoniae. The germ has been found by Frankel, Sternberg and others and although all seem agreed that it may be produced by this micro-organism, yet it is not absolutely certain that it always produces

the disease. There have been several other germs found in the lung along with this special one, notably the coccus of suppuration, which is present in a large per cent of the fatal cases, and the baccillus of Friedlander which was at one time considered the specific germ and by some writers, such as Netter, (Arch. de Med., Paris Jan. 1892) is still said to be of most frequent occurrence in test cases. We are justified in saying that those of Frankel and Friedlander are most frequently found either singly or together.

The Diplococcus pneumoniae may be found in healthly conditions or in cases of meningeal or pleuritic effusion without any pneumonia. They are usually enclosed in capsules, which disappear on cultivation, are non-motile and are with great difficulty cultivated. They are easily recognized by taking some sputum, putting it in a sterilized cover glass, staining for 5 or 10 minutes in metheylene blue, washing, drying and mounting, then examining with the microscope.

The disease usually affects the entire lobe or it may be that the whole lung or even both lungs may be involved. The order of frequency in which portions or the entire lungs are involved are right lower lobe, left lower lobe and double pneumonia. The apices are rarely affected the right more frequently than the left. The different parts of the lung affected may not be in the same condition pathologically at the same period of time, in other words, at one part the disease may be further advanced than at another.

Three different stages are recognized. (a) Engorgement, congestion, hyperemia or splenisation. In this stage the lung or the part affected is red in color and larger, it floats in water, although not with so great buoyancy as it does in the normal condition. On section blood serum and froth exudes from the surface. Under the microscope the cappillaries are seen to be tortuous, distended and sometimes saccular. The epithelium covering the air vesicles becomes swollen and desquamates. The air cells being filled up with serum, leucocytes, red blood cells and epithelial cells. This stage differs from what is spoken of as hypostatic congestion, also called splenisation, in that the condition is not confined to the dependent portion of the lung, the condition being inflammatory, the exudation like an inflammatory exudation. This stage may last for a few hours or it may be several days, rarely more than, or even as much as, two or three days. It may end in death, which is rare at this stage unless associated with some debilitating condition, or in recovery which is also rare at this stage, or else pass into the next stage.

(b) The second stage is termed the stage of red hepatization. The lung becomes hard like liver, much heavier, larger, will not float in water, does not crepitate on pressure and on cutting is quite granular. It will break but will not bend and on section blood serum and froth exudes. The granular appearance and feeling is due to a coagulation of the fibrin.

On microscopic examination the blood vessels are still seen enlarged and

tortuous, although scarcely so much distended perhaps, as in the earlier stage. The exudation into the vesicles has coagulated and in doing so has entangled the leucocytes, red blood cells and epithelial cells, so that these different structures are found on examination. Leucocytes may be found in the vesicular and bronchial walls as well as in the exudation. Pneumococci may be present, signs of pleurisy are mostly always apparent.

(c) The next stage, that of grey hepatization. brings about an altered appearance of the lung. The organ is soft, tears easily and bends readily, thus differing from the last stage where it always breaks rather than bend. It is greyish or greyish yellow in appearance. When examined with the microscope no fibrin is visible, the vesicles being filled with cellular elements approaching in type to catarrhal pneumonia. The cells and leucocytes are seen in various stages of fatty degeneration while fluid again collects in the vesicles. These changes in the cells, in the connective tissue around and the fluid accumulation in the vesicles, along with the liquefaction of the contents cause a softening of the whole mass; thus leaving it in a condition for expectoration or absorption by whch it is removed.

This variety may end in resolution, gangrene, abscess or leave caseous masses which may remain encapsuled or form a nidus for tuberculosis. There may be also lesions associated with or following this condition, e. g., pleuritis, pericarditis, endocarditis, arthritis, peritonitis. meningitis etc. An interesting fact in connection with these conditions is that the pneumococci are nearly always present and there is a marked tendency to suppuration.

2. Lobular, Catarrhal or Broncho-pneumonia, sometimes also called capillary bronchitis. This disease is most frequently found in children. It is rarely a primary affection, following such conditions as measles, whooping cough, diphtheria, small pox, sometimes typhoid or other specific fevers. The different names applied to it are not explicit unless it be broncho-pneumonia. It affects either one lobule or several lobules, beginning usually in the finer bronchi, spreading from this to the alveoli. In tubercular conditions this rule may not apply, seeing that the disease may become established as the result of the tubercular germs being deposited in the alveoli. It is a common factor in the determination of life after debilitating diseases, such as Bright's disease or chronic cardiac disease. Seeing that the disease most commonly affects children and also the aged, some peculiarity of structure might be expected and this has been explained by the difficulty at those two extremes of life, in having the terminal vesicles completely evacuated. The muscles being weak and also the elasticity of the tissues deficient. Again there is in children and old persons a pecular liability to disturbances of the gastro-intestmal mucous surfaces and if we apply the same principle may there not also be a liability to disturbances of the pulmonary mucous surfaces. Further than this, there is the fact that in children the epithelium is abundantly thrown off on very

slight irritation. On microscopic examination the alveoli become filled with epithelial cells, leucocytes and mucoid exudation, not fibrinous as in the lobar variety, consequently the contents are fluid. The capillaries are distended and the lymphatics engorged.

Areas of the lung are frequently collapsed, the collapse being due to the obstruction of the bronchi with mucous, while the surrounding areas may be emphysematous. There is a marked tendency to suppuration and gangrene in this variety. These inflammatory products usually undergo fatty degeneration, break down and become discharged or partly absorbed. Sometimes the collapsed portion never regains its normal condition, or it may be, the condition becomes chronic resulting in a permanent inflammatory thickening and consequent induration. Sometimes even these attacks are followed by phthisis-pulmonalis, athough this is rare. If it does take place probably it is tubercular from the start, simply localized to particular areas.

3. INTERSTITIAL PNEUMONIA. This is a chronic inflammation which involves the connective tissue. This same result is produced by any irritation of lung tissue and hence the diversity of names applied to the condition. In consequence of the hadening of the connective tissue, the lumen of the air cells is diminished and replaced by fibroid growth. The disease is usually confined to one lung. It is grayish in color, solid to touch, dense and bulky. Sometimes it is very small. Under the microscope the alveolar walls are seen to be thickened by fibrous tissue which interferes as already mentioned with the lumen of the cells sometimes filling it up. The overgrowth may be estimated by the fact that the lung is not reduced in bulk. The pleura is frequently adherent. As a result of the chronic inflammation cicatrical contraction takes place and thus destroys the contour of the lung tissue. There is a tendency to shrink just like cirrhosis of the liver. This shrinkage leads to dilatation of the bronchi and a conditionknown as bronchiectasis (dilatation of the bronchus) results. The secretions are retained in these conditions. There is a tendency for them to decompose, form ulcerated areas and ultimately cavities, which may simulate tuberculosis.

We have several other forms of pneumonia in addition to. those mentioned, e. g.

(1) Secondary or complicating pneumonia which appears as a complication of surgical operations, diseases of the brain and spinal cord or any disease where a long recumbent posture is required. The posterior part of the lung may be affected in patches, without any relation to the bronchi, simply being tough and fibrous,or having the characteristics of a broncho-pneumonia.

(2) THE PNEUMONIA OF HEART DISEASE. It is usually present where the aortic or the mitral valves are affected or any condition giving rise to a prolonged pulmonary congestion. The lungs are smaller in size with black or brown spots, the so-called brown or pigment induration. The capillaries are

dilated and the coloring matter present in the desquamated epithelial cells.

(3) TUBERCULAR PNEUMONIA. This is a term applied generally to all the inflammatory affections of the lung due to the tubercle bacillus. The general characteristics of the condition have already been referred to under tuberculosis.

(4) SYPHILITIC PNEUMONIA. We may have this condition existing in one of two forms, either as a hereditary condition or as the result of a primary infection. In the former what is known as white hepatisation is frequently seen, it is the result of the obstruction of the vesicles during foetal life, so that after birth the vesicles still being obstructed no air enters, consequently the area involved is supplied only with blood for nutrition and therefor remains pale. The ordinary syphilitic gumma may be present also in the hereditary form, being situated at or near the roots of the larger bronchi. In the acquired form there is usually an interstitial inflammation produced, associated with the ordinary phenomena of that type of pneumonia, but characterized according to Virchow, simply by beginning at the bifurcations of the larger bronchi. Gummata are frequently found in this variety, which if recent are usually encapsuled by a translucent fibrous membrane. but if more ancient the capsule becomes hard, opaque and dense.

(5) SEPTIC PNEUMONIA. This septic infection may result from the inhalation of the pathogenic micro-organisms, or may be the result of a septic process in the tissues of the body; somewhere, gaining an entrance into the general circulation, being carried and deposited in the substance of the lung and setting up the specific inflammation at that point. The result of this infection is the production of a localized abscess and the condition would then be more correctly spoken of as an abscess of the lung than a as septic pneumonia. The pathology of an abscess of the lung is similar to that of an abscess elsewhere with the exception that the abscess may open into one of the bronchi and be discharged through the respiratory tract, or it may open through the chest wall and evacuate itself in that direction, or it may become encapsuled and remain encysted. The walls of the abscess cavity from within outward consist of an area of inflammatory tissue and degenerating lung tissue, then a zone of solidified lung with an inflammatory infiltration of cells and external to this an area of oedematous lung tissue.

OTHER DISEASES OF THE LUNG.

BRONCHITIS. We have two varieties of this condition, an acute and a chronic inflammation of the mucous membrane of the bronchial tubes.

In the acute variety there is at first the congestion manifested by the dry or it may be sticky surface, following this there is the exudation of the mucous in more or less abundance and the swelling, degenerating and desquamating of the epithelial cells which are characteristic of the catarrhal inflammation. The disease rarely gets deeper than the epithelial cells. If the secretion of the

mucous be abundant and clear, the condition is spoken of as bronchorrea should it be partly purulent it is termed a bronchoblennorrhea.

The chronic inflammation of the bronchi results in the formation of fibrous tissue in the walls of the bronchi and the same succession of changes appear as in other chronic inflammations, the function becomes interfered with and there is a lessened secretion producing the so-called dry catarrh, or there may be contraction and the condition already referred to as bronchiectasis results.

There is another form spoken of as putrid or septic bronchitis, where the secretion has become infected and as a consequence is purulent. It is more likely to be a stage simply in one of the former processes.

BRONCHIECTASIS. This is a condition where dilatation of the bronchus has taken place and is usually a sequel to some other form of lung disease. whereby the tissues have become softened and more readily impaired. There is a variety which is spoken of as congenital where the condition is found in one side of the lung and there are more bronchiectatic cavities as compared with the other form. The cavities are irregular in size, but usually more or less tubular in form. It is distinguished from a tubercular cavity by its walls which are smooth and covered with epithelium, by the direction of the cavity being always in the line of a bronchus and if ulceration has taken place, the ulcerated surface is the most dependent part of the cavity. These cavities are frequently the starting point of a tubercular condition. The cavities nearly always contain some putrid secretion and accumulated debris.

EMPHYSEMA. There are two distinct varieties of emphysema. The first or interstitial form, where the connective tissue portion of the lung is involved and becomes distended with air, usually the result of an injury or extreme expulsive violence as in whooping cough. The second or true emphysema, or as it is sometimes termed compensatory, where an area of the lung becomes distended and ts function increased in order to compensate for some deficiency, as in apneumatosis, where an area of the lung is collapsed and takes no part in the function of respiration. Another term is sometimes used in connection with this variety, or perhaps it would be better to say a type of this variety, this term is hypertrophic emphysema where the tissue of the lung seems increased depending upon an increased pressure within the lung tissue, associated with bronchitic conditions. In this variety the margins of the lung extend over organs such as the heart and the liver, giving as a clinical symptom an increase in the area of resonance. On section, the tissue of the lung consists almost entirely of spaces produced by the running together of several of the vesicles, the septa between these vesicles becoming atrophed and ultimately ruptured. The elastic tissue in the lung and the capillaries atrophy. The area of lung is increased so far as bulk is concerned, but diminished so far as the aerating capacity is concerned. These same conditions are present in a

form of emphysema referred to by Jenner as atrophic emphysema, the lung in this case being small, evidently having undergone atrophic changes.

APNEUMATOSIS This condition exists in a congenital form where the lung does not expand after birth, or it may exist as an acquired condition, following some form of disease, or depending upon some obstruction to a bronchus and in this way cutting off chances for the air to enter the lung. There are few pathological signs apparent, apart from the condition of collapse, sometimes the color of the lung changes and sometimes the area becomes fibroid as the result of the change taking place in the tissue.

HEMORRHAGIC INFRACTION. This disease is frequently spoken of as pulmonary embolism and is the result of an embolus of some form, in passing through the lung, causing an obstruction to the flow of blood through an artery. It most frequently happens to obstruct one of the end arteries and in this way we have a wedged shaped area of lung tissue involved. This area becomes congested with blood and depending upon the amount of congestion there is a discoloration and more or less turgescence. If non-infective an absorptive process follows, the fluid disappears and the color changes as the result of the absorption. Sometimes the area becomes fibrous or it may be this same area may soften and break down, particularly if the process was infective, in that case there might be a gangrenous condition, or the formation of an abscess.

GANGRENE. Gangrene exists either as a localized or a diffused condition. It takes place as the result of an impaired nutrition associated with some form of infection. The portion of lung involved is in a very putrid condition usually and the area of lung surrounding this diseased portion is markedly congested, and infiltrated with cells with a still external zone of oedematous tissue; we have in fact the formation of a wall similar to that of an abscess cavity.

HEMOPTYSIS. This is a term which is applied to the spitting of blood. Blood may come from the lungs from quite a variety of different causes, the consideration of the causes being practically the extent of the pathology of the condition. We have it of course as the result of rupture of one of the vessels in pulmonary tuberculosis, we have it as the result of an aneurismal ulceration, we may have it as the result of an injury, or we may have it simply from a pulmonary congestion which may be entirely pulmonary or the result of a cardiac leison. It is said also to occur as a result of a fatty degeneration of the walls of the vessels. The blood may accumulate in the alveoli and set up a catarrhal inflammation, it may become fibrinous in the alveoli, or it may be, as some claim, that it undergoes an actual necrosis, not merely itself but causing a necrosis of the pulmonary tissue, probably however, only if the lung tissue be already diseased.

DISEASES OF THE COVERINGS OF THE LUNGS.

The pleura which covers the lung is a serous membrane and as such is a type of the different serous membranes in the body. We have several affections of the pleura, a pleuritis or inflammation of the pleura, which may be either acute, chronic or suppurative. In the acute form the first change appreciable is the disappearing of the glistening surface, succeeded by an exudation which may be either serous, fibrinous or sero-fibrinous. If the exudation is fibrinous or sero-fibrinous there is a layer of fibrin deposited on the wall of the pleura, this fibrin passes through the changes that an inflammatory exudation usually does, that is to say, it is at first embryonic tissue and as it becomes vascularised forms a granulation tissue and this granulation tissue may pass into a fibroid tissue. What frequently happens in these cases, is that the granulation tissue on the adjacent surfaces come together, unite and obliterate the cavity of the pleura. This is what is spoken of as adhesive pleurisy. If the exudation is serous or mainly serous and long continued we have an accumulation of fluid in the pleural sac, this is pleurisy with effusion. In these cases whatever fibrin is present becomes deposited on the wall and remains there as thickenings, or as shreds, suspended from the walls.

CHRONIC INFLAMMTION is the result of the acute and usually consists in thickening, adhesion, or masses suspended from the walls, in some stage of an inflammatory process, simply fibroid tissue, calcareous or caseous masses or zones of infiltration of fat.

SEPTIC INFLAMMATION is the result of pyogenic infection and as a consequence there is a formation of pus, an accumulation of which is known as an empyema in the pleura. The pleural surfaces are practically the walls of an abscess and on examination the walls correspond in structure to the walls of an abscess in any other location. (see abscess of lung)

TUBERCULAR INFLAMMATION. These inflammations may be either acute or chronic, the result of the deposition of the tubercular germ, frequently from some neighboring structure. In the acute form, the changes are practically similar to those occurring in the acute simple form, only that instead of the formation of new tissue there is the tendency to necrotic changes, similar to those found in connection with tuberculosis of any other structure. A section of the tissue shows the typical tubercle within the area of inflammation. The chronic form is associated with the results of a chronic inflammation and the caseation of tubercular areas.

Other diseases of the pleura are, the formation of tumors which may be either primary or secondary, the former always of the connective tissue series, the latter mostly carcinomata; the development of cysts; parasites and such infective conditions as actinomycosis and glanders.

DISEASES OF THE HEART.

ATROPHY. The size of the heart like all the other organs of the body is variable, even under normal conditions. In general diseases we meet with diminution in bulk of an organ or structure and just in the same way, we have diminution in the size of the heart. This is seen in any form of emaciating disease, such as cancer or tuberculosis, where the whole of the cardiac structure becomes diminsihed, the color changes to a somewhat darker hue and the coronary arteries become very prominent. The chambers of the heart may not be altered, but usually speaking, they are diminished, very rarely increased. In addition to this form of general atrophy, there may be two other atrophic conditions, either local, the result of an impaired function and nutrition, or what is spoken of as brown atrophy, where there is as the result of persistent congestion, an accumulation of granular pigment from the blood. In atrophy, either general or local, the pathology of the structure can be described as a general or local diminution of tissue, the fibers either simply shrinking or it may be a numerical diminution of the fibers.

HYPERTROPHY. This is a condition just the reverse of the above, but like it there may be either a local or general change. It is common to speak of several different forms, for example simple hypertrophy, where there is an increase in function as well as size, the cavities remaining normal; eccentric hypertrophy, where there is in addition to the increase in size and function, an increase in the size of the cavities; and concentric hypertrophy, where in addition to the increase in size and function there is diminution in the size of the cavities. In most cases we have to consider the question of dilatation, seeing that there is in many a mechanical interference with the flow of blood. The dilatation may be the primary condition, the heart being overloaded and the extra work produce the hypertrophy. Simple hypertrophy is probably rare, but may exist and it would almost seem better to look upon the condition as phsiological, rather than pathological.

In the hypertrophic heart there is a marked change in appearance. If the condition is general the organ assumes massive proportions and is freqently referrred to in that condition as a bovine heart, that is, it resembles the heart of an ox. In local hypertrophy where either the right or left ventricle is involved, the normal contour of the apex is lost and an increase presents itself, depending upon which of the ventricles has been affected, usually the left. The increase in size may be due to an increase in the size of the muscle fiber, probably also an increase in the number of the fibers. The tissue as a whole becomes more dense and may be more deeply colored.

DEGENERATION. There are several varieties of degeneration, but perhaps the most common being fatty, hyaline and amyloid or albuminous.

Fatty degeneration presents itself in three different forms, local, general and toxic. The area affected becomes lighter in color and on close examina-

tion, the muscle fiber is found to be absent and its place taken by these adipose tissue cells, sometimes the muscle does not entirely disappear, in those cases there is a part of the tissue composed of fat and a part of it muscular. The local differs only from the general simply in the extent of the degeneration. The local condition is frequently followed by a bulging of the diseased portion, spoken of as an aneurism, sometimes it results in rupture. In the toxic form the local symptoms are similar to those already mentioned, the only characteristic being that it follows such forms of chronic poisoning as phosphorous, arsenic and antimony.

Hyaline degeneration is a condition where the muscle fiber becomes converted into this peculiar structureless tissue spoken of as hyaline. The tissue has a structureless ground-glass appearance, and on staining does not take on any coloration. There is a condition spoken of as muscle segmentation, or as it is sometimes called fragmentation of cardiac muscle, which is supposed by many to be a form of the hyaline degeneration. Whether it be hyaline or some distinct form of degeneration is not quite clear, but the initial disturbance seems to affect the cement substance and results in a very perfect demonstration of the fact that cardiac muscle is composed of elongated cells.

Amyloid disease as it occurs in other organs is rather rare in its occurrence in the heart muscle, but there is a form of degeneration which is spoken of as albuminoid where the tissue becomes filled up with granules of albuminoid material. It is most frequently found in association with fevers. The diseased condition spreads rapidly, the whole of the cardiac muscle may very soon be affected and its structure obscured. On examination the fibers are almost covered by these very fine albuminous granules. It may be an initial stage in diffuse fatty degeneration.

INFILTRATION. There are several forms of infiltration which affect the cardiac muscle. We have fatty infiltration in which there is an abnormal accumulation of fat in the tissues, but quite different from fatty degeneration in which the fat takes the place of the muscle fibre whereas in this condition the fat is thrown in between the muscle fibres. It is present in cases where there are general accumulations of fat as in general obesity, but may be present also in cases where there are wasting diseases. The pathology of the condition consists in the superabundance of fat cells in the normal cardiac muscle, with perhaps sometimes a shrinking of the muscle fibre.

CALCAREOUS INFILTRATION sometimes takes place, although its occurrence is rather rare. It follows upon some inflammatory condition, and may be found in patches sufficiently large to be seen with the naked eye. On examination the tissue presents an altered appearance so far as the color is concerned, but also at times the muscle fibers become separated, the cardiac muscle cells removed from one another, or it may be that the structure is simply

obscured by fine granules, these granules being salts of lime, as can easily be proved by the addition of a mineral acid—hydrochloric acid.

AMYLOID INFILTRATION may take place in connection with the cardiac muscle and when it does so the tissues assume a milky appearance. The amyloid material can be readily seen with the microscope, but it requires to be differentiated by the staining processes already referred to in the general amyloid condition.

Another form of infiltration has been recognized by some and spoken of as pigment infiltration. This is seen where granules of pigment are distributed in the cardiac tissue, the pigment being derived from the coloring matter of the blood.

INFILTRATION. There are three different forms of inflammatory diseases of the cardiac muscle, the three terms applied to these conditions being acute, chronic and purulent. The acute condition is most frequently an accompaniment of some infective disease, such as scarlet fever or diphtheria, and results in the softening and swelling of the cardiac tissue, the results of the ordinary changes following acute inflammatory conditions. It very frequently leads to the chronic condition or some form of degeneration, provided it does not terminate in suppuration.

The chronic variety, or as it is sometimes called interstitial, is nearly always associated with some lesion of the coronary arteries. The result of the inflammation is the formation of fibrous tissue between the muscle fibers and as the result of the pressure the fibers degenerate. These areas affected may be small and produce fibroid patches, or it may be, these areas are so diffuse as to affect the greater part of the cardiac structure. Some consider that this condition is physiological, that the fibrous structure becomes developed to take the place of the atrophied muscle fibers. and it has been noted that near the blood vessels where there was a sufficient nutrition, the fibrous tissue was not so well developed and the muscle fibers had undergone very little atrophy. These facts, however, scarcely prove enough in regard to the condition to justify one in stating absolutely whether the fibrous change precedes the atrophy or whether it follows the atrophy of the muscle fiber.

The purulent inflammation is nearly always acute and may be diffuse affecting the whole of the cardiac tissue, or as much more frequently happens circumscribed. When circumscribed the condition is simply the formation of an abscess and the pathology of the condition described in a similar manner to the formation of abscesses in tissues generally. The abscesses are usually the result of infective emboli circulated in the blood and caught in the vessels of the heart. The abscess may rupture into the cavity of the heart, the cavity remaining an aneurism of the heart, sometimes the abscess becomes encapsuled and remains.

DISEASES OF THE MEMBRANES OF THE HEART.

THE ENDOCARDIUM. The disease most frequently affecting the endocardium is inflammation in some of its varieties. Acute inflammation of the endocardium presents itself in a simple form in association with acute diseases, such as rheumatism. The part affected being that part exposed to the greatest work, in adult conditions the left side, including the valves, being most frequently affected. The endocardium in the early stage of the inflammation becomes infiltrated, but differs from the infiltration in common inflammations, being in this case serum and leucocytes and hence the milky color of the affected part, which becomes soft and in the case of the valves, where friction is constant the surface becomes broken. On these broken surfaces fibrin from the flowing blood is deposited and this mass of fibrin increases and if it become organized, results in the formation of a warty vegetation. If the abrasion be on the surface of the valve opposite from the current of blood, the weakened part may become invaginated forming a sac, or rupture and result in a spurious communication between the chambers of the heart. The acute form sometimes becomes malignant or what is spoken of as ulcerative endocarditis. This condition is associated with some form of micro-organism and is nearly always present as a sequel in acute bacterial diseases. As a result of the infection ulceration takes place and masses of fibrin accumulate around the ulcer, become detached and circulate through the blood. The ulceration may extend sufficiently to penetrate through the valves, or if on the walls remain as deep ulcers, rarely ever cicatrising.

Chronic inflammation results in the formation of fibroid tissue and if in the valve causes thickening and contraction, resulting in insufficiency. Degeneration may take place, principally the calcareous variety. In the chronic form vegetations are common on the margins of the valves and frequently become broken off and form emboli.

THE PERICARDIUM. This is a serous membrane and as such resembles the pleura and is affected by diseases in the same way as the pleura. (See diseases of the lungs.)

DISEASES OF THE BLOOD VESSELS.

THE ARTERIES. The arteries are subject to diseases just like other structures. There is a continuation of the inner wall of the artery with the endocardium, the capillaries and veins and as a consequence one would look for a similarity in the tendency to disease, but we find that such is not the case by any means for we rarely meet with an acute inflammation of vessels. It is present as the result of injury however as is well illustrated in the ligature of an artery. The result of the inflammation is the formation of a thrombus within the vessel and exudation into the walls of the vessels, which if the condition be septic forms pus, if less acute thickening of the walls.

It is much more common to find chronic inflammations and one of the conditions it presents itself as is spoken of as atheroma. In this variety there is thickening of the inner coat in patches, which are hard and elevated, they were at one time looked on as deposits on the surface of the intima, but we now know that they result from the changes taking place in the intima. The intima is infiltrated with cells and becomes thicker on account of the new formation of connective tissue. These patches undergo fatty degeneration and necrosis, so that there is within the substance of the patch this fatty debris, which has received the name of atheroma. If this material remain in the center of the patch it forms an atheromatous abscess, should it open into the artery it is an atheromatous ulcer.

Another form is spoken of as obliterating endarteritis. It it present in the smaller vessels and manifests itself by a gradual encroaching upon the lumen which may be completely obstructed. The growth of this fibrous tissue takes place in this case in rings around the intima and not in patches as in the atheromatous condition. The new tissue is well supplied with blood and consequently there is no tendency to fatty degeneration. The coats external may be affected becoming thickened, Some consider that it is the result of syphilis.

We may also have a suppurating form of inflammation the result of injury, or of infection through the circulation. The infection results in the formation of pus which may either be discharged like ulcers always do, or it may be collected and form an abscess in the walls of the vessel.

There is a variety—tubercular arteries—which principally affects the smaller vessels and results in thickening and obliteration.

The chronic irritation frequently results in the degenerating of structures and so there are areas of softening in some cases, in others the development of calcareous plates the result of the deposition of the salts of lime. Other forms of degeneration are hyaline, amyloid and fatty. The fatty condition is manifested by the excess of fat. It may be the result of general obesity or disease.

ANEURISM. We have several forms of this disease and terms have been applied to express the condition which in a a great many cases are scarcely correct. We find that there is a condition referred to as a traumatic aneurism, which is simply an accumulation of blood in the tissues after an injury, in fact it is a hematoma or blood tumor. Again, there is the term cirsoid aneurism, which refers to a dilatation of the medium sized arteries, which become elongated and very tortuous. It takes place as the result of an injury affecting, it is supposed, the vaso-motor nerves, and is nearly always found on the scalp. Still another variety is spoken of as varicose aneurism where there is a communication between an artery and a vein.

What we speak of as an aneurism, however, in its strictest sense, is where

there is a localized dilatation or formation of a sac on the wall of an artery. The sac is variable in size and shape, but for the most part the shape is such that the condition is spoken of as saccular and it is said to have a neck and to open into the artery through its mouth. An aneurism may be fusiform, cylindrical, or, as stated above, saccular.

The wall of the sac is made up of some of the coats of the normal artery. If the aneurism be small it will probably have all the coats, but as the result of stretching, the coats, especially the middle one, become thinned out and some times give way so that there are only two coats remaining, the inner and the outer. The inner coat may rupture also and allow the blood to get in between, and in this way we have a dissecting aneurism, which means that the constant flow and pressure of the blood separates the layers in the wall of the vessel. When the pressure is great and the aneurism large, the wall of the sac may consist simply of fibrous tissue, in fact the wall may consist of tissue entirely distinct from the tissues usually found in the wall of the normal artery. Of course the sac may rupture and in that case the contents of the aneurism would be set free, the contents being blood and more or less blood clot.

THE VEINS. The diseases of the veins with which we most frequently meet are inflammation—phlebitis—and the various forms of dilatations.

We may have an an acute inflammation of the veins resulting from an injury or infection, when from the former the walls are congested and infiltrated with serum, but should it be the result of an infection the congestion is similar but the infiltration in either case the inflammatory condition may extend to the external coat, involving them all, or simply involve some of them.

The chronic form results in the thickening of the walls of the vein and may extend to the external coat, or simply affect the inner, in that case the results are somewhat similar to the same condition in the case of the artery. If the condition extend far enough there is entire obliteration of the lumen.

The chronic inflammation sets up an inflammatory condition external to the vessel wall and so we have as a consequence the eczematous condition of the skin. In addition to this there may be coagulation of blood within the vessel and this coagulum become infiltrated with the salts of lime when we have the vein-stone or phebolith formed.

The dilatations of the veins are spoken of as varicose veins. The varicose condition is simply a localized enlargement of the calibre of the vein. It results from an increase in pressure associated with some interference with the tissue, probably of a nutritive nature. There are several different locations where the varicose condition is most frequently present. The lower limb seems to be specially fitted for the establishing of the condition and it is easily explained when we consider the dependent posture of the limb, the column of blood which extends upwards and the possibilities for the obstruction to the flow by pressure in the abdominal cavity, along with the upright posture and

the consequent contraction of muscle fibers in the limb. It is supposed to affect the external vessels only but the probabilities are that it, frequently a least, affects the deep vessels also. The dilated und thinned wall may rupture and result in very severe hemorrhage on account of the incompetency of the valves above the lesion. The skin may ulcerate over the area and assist in the process of rupture.

The varicose condition in veins of the rectum is spoken of as hemorrhoids. The veins lie immediately below the mucous membrane and are continuous with the vessels in the abdominal cavity and as a consequence pressure from any condition within that cavity produces an obstruction to the flow of blood, the vessels are dilated and the passage of fecal matter presses directly on the vessels and they ultimately protrude, the tissues being more or less injured. Varicocele is the term applied to the dilated condition of the veins of the spe matic cord and external scrotal veins. It is usually present on the left side, probably because the vein has a circuitous course and opens into the left renal vein, whereas the right is more direct and opens directly into the inferior vena cava.

THE CAPILLARIES. The walls of these vessels are thin and consist only of a single layer,still they are subject to inflammations, degenerations and dilatations,in the same way that the other vessels are and with similar results up to the extent that their size and the thickness of their walls will permit.

The different vessels are subject to the formation of tumors in the manner described in the chapter on tumors. In addition, however,to the true blood tumor maligant tumors may develop, chiefly secondary and sarcomatous, although carcinomata and simple forms of tumor may also be present.

DISEASES OF THE BLOOD.

We have already made a reference to general circulatory disturbances,but we omitted what are generally considered true blood diseases.

ANAEMIA. It is quite true that anaemia was mentioned but only in a general way and chiefly in reference to local forms. There are some other forms which we will briefly mention. General anaemia refers to a condition where there is general interference with the blood and it may exist as a primary condition or as a secondary. The former is due to some disturbance in the blood-making organs, or else an interference in the normal utilization of the blood. We have a good example of this condition in chlorosis. Chlorosis is mostly found attacking females about the age of puberty and for that reason supposed by some to be associated with some defect in the generative organs, but is much more likely to be the cause of the symptoms associated with the disease, than actually to produce the disease. It has been found that in some of the cases there was an abnormal narrowing of the aorta and its branches, and for that reason it is considered possible that Virchow is correct in his theory that there is an abnormal condition of the blood preparing organs.

The blood is characterized by the loss of the normal proportion in the red and white cells, in some, the reduction being considerable. The coloring matter also disappears to some extent, sometimes losing 75 per cent of the normal and it may be that the diminution in the coloring matter is quite out of proportion to the loss of the red cells.

Pernicious anaemia is another form of primary anaemia. In this form there is a very great reduction in the proportion of red cells without any apparent cause. There is an alteration in the marrow of bone, which instead of being normal becomes semi-fluid, reddish in color and on examination is found to consist of small, red, nucleated cells which are also preset in the blood. It is not clear what the significance of the change in the marrow is, but it is supposed to indicate that there is an alteration in the blood organs.

The secondary anaemia follows such conditions as hemorrhage, prolonged suppuration, or any wasting disease and absorption of poisonous products.

Anaemia produces changes in the tissues which are distinctly pathological, the result of the changes in the blood. There is a fatty degeneration of the cardiac muscle, the tubules of the kidney, the hepatic cells and the mucous membrane of the aorta. (Virchow.)

LEUCOCYTOSIS. The condition referred to by this term signifies the abnormal production of the white cells. It is often a physiological condition as after the eating of a meal, or during the period of gestation. The pathological condition is seen in acute diseases such as pneumonia, or in septic diseases. The blood may be greatly altered, the proportion changing from normal—1 white to 400 red—to 1 white to 20 red. Another form, of a pathological nature is sometimes called LEUKAEMIA, in which there is a distinct alteration in the blood organs, in addition to the change in the blood. The spleen, lpmphaties and marrow become hypertrophied, hard and pale in color with a tendency to hemorrhage into their substance. The liver also enlarges and collections of round cells appear, which have frequently been mistaken for miliary tuberculosis, they differ in that there are no giant cells. The blood may have an equal number of white and red cells but this equality need not be the result of the leucocytosis, it may be that the red cells have been reduced in quantity. The specific gravity of blood becomes less, and after death crystals have been found by Charcot and are named after him. They are small, clear and colorless of octohedral shape. The change in the blood is probably due to the destruction of the red and the increase of the white.

The term PSEUDO-LEUKAEMIA is applied to a disease which is better known as Hodgkin's disease. It differs from true leukaemia in that the blood itself is not much altered, perhaps not at all, in that case the changes taking place are confined to the blood organs.

MELANAEMIA. There is in this condition pigment floating in the plasma

and also in the white cell.   The pigment may be the normal coloring matter of the blood or it may be derived from other sources as the bile, in that case it is called cholemia.   The cells pass out into the organs and   cause pigmentation of their substance.

URAEMIA is scarcely a disease of the blood, yet there is a   change in the blood which depends upon the retention of   urea in the system.   It is   quite true that it is not produced by the injection of urea into the blood, but it can be, if the excretion is prevented.   At one time it was considered to be due to carbonate of ammonia in the blood and Traube very nicely suggested that the symptoms were probably due to oedema of the brain, neither supposition being at all likely.

A few other conditions are recognized, for example, OLIGOCHROMEMIA which signifies that the coloring matter is deficient; HEMOGLOBINAEMIA where there is an excess of coloring matter, this is seen in pernicious anaemia where the number of red cells are reduced, the coloring matter remaining the same. OLIGOCYTHAEMIA refers to the diminution in the red cells.

DISEASES OF THE GASTRO-INTESTINAL TRACT.

THE MOUTH.   It is not uncommon to meet with cases where there has been a failure in the normal process of development manifested by the clefts of the lip, face or palate.   The condition is easily understood when we consider that the normal face is formed by the union of certain processes from either side.   The failure in the union resulting in the greater or less separation of the parts so that we have a hare-lip, or cleft plate or even an entirely cleft face, including the lower jaw.

INFLAMMATION.   There are several different forms of inflammation of the mouth, or, as it is called, stomatitis. Simple stomatitis is common in children although it may be present in the adult also.   It exists as a catarrhal condition, the mucous membrane being congested and swollen, the epithelial cells degenerating and separating, with sometimes an increase in the flow of saliva.   Ulcerative stomatitis usually appears at the teeth, spreading to the gums or cheeks later.   The ulcers are moderate in size, with sloughing tissue in their base, giving rise to the foul odor associated with the disease.   It is supposed to be caused by a micro-organism and is often found in cases of mercurial poisoning, in debilitating disease and lack of proper hygenic care of the mouth.   Specific stomatitis results from such specific diseases as syphilis and tuberculosis, in which there is the formation of gummatous tumors or mucous patches in the former, the development of tubercular masses of various size in the latter, with the degenerations associated with the disease and ultimate ulceration.   Aphthae, or fungus stomatitis, presents itself as elevated patches of white or whitish yellow growth, which seems to be elevated above the level of the surface, but is really an ulcer.   The fungus is present and, it usually begins on the tongue or lips and the mucous membrane is nearly al.

ways dry, in these respects differing from the ulcerative form just mentioned. It is a common associate of dyspeptic conditions in the child or the adult. Another form is frequently found as a sequel to the acute febrile diseases of childhood and is spoken of as noma or gangrenous stomatitis. It begins at the angle of the mouth, spreads rapidly to the other parts of the mouth including the bone, and if not quickly stopped, will destroy the tissues very extensively. We often find malignant conditions, which could be referred to as malignant stomatitis, although it is more common to refer to them under the head of tumors of the mouth. The form most frequently met with is epithelioma, either of the tongue or the lips, sometimes sarcomata are present in connection with the jaw or gums.

Tumors of the mouth are rare, if we except those already spoken of as malignant stomatitis. We have a few simple forms, chiefly adenoma, either in the mucous membrane or as polypoid growths where normal gland structure exists; papilloma, angioma, fibroma and lipoma, mostly in connection with the lips.

THE FAUCES: The disease affecting the fauces most frequently is inflammation in some of its different forms. There is the acute inflammation, which used to be spoken of as angina, in the simple form there is simple swelling, redness and an increase in the exudations, but in the specific forms, which we speak of as diphtheria and scarletinal tonsilitis, it goes on to the special changes taking place in these particular diseases. The chronic inflammation is characterized by the increased thickening of the mucous membrane, which is well shown in the elongated uvula, the thickened tonsil and the follicular pharyngitis, sometimes by the enlarged and varicose veins in that region which so frequently cause alarm to the wary on account of the hemorrhage coming from them. The acute condition called diphtheria is specific, the inflammation severe, giving rise to a considerable amount of exudation of a fibrinous nature, which undergoes coagulation necroses, involving the mucous membrane to a certain extent, and forming the dirty white, or greyish white, membrane so characteristic of the disease. The tissues underneath are infiltrated with cells, the result of the inflammatory process. Loffler's bacillus is found in all true forms of diphtheria. The membrane consists of fibrine and cells caught up in the process of coagulation. The other acute condition met with as tonsilitis may be either alone or in association with scarlet fever. The tonsil is much enlarged, the color markedly red and usually terminates as an abcess, an ordinary abscess of the tonsil being referred to as quinsy.

Ulceration of the fauces results from the syphilitic condition, the ulcers being deep, and sometimes in tuberculosis although not so common as in the larynx.

The tumors of the fauces are mainly those of a papillomatous, cystic, carcinomatous or sarcomatous nature.

THE OESOPHAGUS. In speaking of the oesophagus it is necessary to remember that it is a continuation of the pharynx, that they consist of muscle fibre, fibrinous tissue and mucous membrane. The muscle in the upper part is mainly, if not altogether, of the voluntary type, the lower part involuntary.

We have inflammations the result of injury, or the spreading of the same condition from the mouth, sometimes it is of the fungus variety, at others, simple, or it may be of the diphtheric type. Syphilis may affect this portion as a gummatous formation leading to constriction.

Stenosis exists in two different forms, either as a spasmodic condition. such as we often meet with in hysteria, or as an organic contraction following some traumatic process, malignant growths or even pressure from the surrounding structures. The result of the obstruction is the formation of dilatations in the oesophageal tube, these dilated areas are usually cylindrical. There is a form of dilatation, the cause being obscure, where they appear in saccules on the side of the tube.

Ulceration of the oesophagus sometimes takes place as the result of injury, pressure from aneurisms or tumors, and sometimes malignant conditions.

Tumors are usually carcinomata, sometimes sarcomata. or the simple forms mentioned in connection with the mouth.

THE STOMACH. In considering the diseases of the stomach, we must bear in mind the fact, that the organ normally is concerned with the process of digestion and as a consequence may be readily affected by slight changes in that normal function. We also require to remember that the secretions of the gastric glands are digestive, and in this way we can understand the post mortem softening that nearly always takes place in the mucous membrane, and further, when we have cases of sudden death, the body being kept warm, we may have areas of the mucous membrane entirely digested and looking like ulcers, in fact there may be a digestion of the entire wall of the stomach.

Inflammation presents itself in three forms, either as an acute condition, which is rare unless in cases of poisoning when the mucous membrane is swollen and red, the epithelium destroyed; or as a sub-acute gastritis where there is congestion and frequently ulceration of the mucous membrane, the glands enlarged and granular, frequently in association with such diseases as the eruptive fevers; or chronic gastritis which is much more frequent than any of the others mentioned. In the latter form there is thickening of the entire wall of the stomach, the mucous surface thrown into folds, the glands are atrophied as the result of the pressure and sometimes entirely fibrous, their function being lost. The disease is frequently a sequel to alcoholic excess or any continued congestion.

Ulceration of the stomach is not uncommon, the term applied to the form most frequently met with being "the perforating or simple ulcer." It is usu-

ally situated on the lesser curvature towards the plyoric orifice, on the pos-
terior aspect of the stomach, although it may present itself on any portion of
the wall of the stomach. The ulcer is usually single somewhat circular in
shape with a punched out appearance, in fact looks as if it had been gouged
out from the inside of the stomach. The base of the ulcer is smooth, and may be
composed of any portion of the wall of the stomach depending on the depth of
penetration and may actually open into the cavity of the abdomen or have a
base formed by the organ on which the stomach rests. The cause is obscure
but is generally thought to depend, to some extent, on emboli in the vessels of
the stomach, associated with an increase in the acidity of the gastric secretion.
The ulcer may heal, and if it does so the walls are drawn so that the mucous
surface is puckered. If the ulcer is chronic the edges become elevated and the
stomach adherent to some neighboring organ. Sometimes a sloughing ulcer is
found in syphilitic persons and develops rapidly.

Hemorrhage is very often in association with the condition just mentioned,
also in malignant disease of the stomach, but may be present also in any case
where there is obstruction to the blood through the liver, either as the result
of disease of the liver or the heart. The blood from the stomach is dark col-
ored, acid in reaction, clotted and mixed, at times, with food.

Dilatation of the stomach exists as an acute condition, where there has been
an over distension of the organ, or chronic as the result of an obstruction at the
pyloric orifice, or simple atony of the walls in dyspeptic conditions, where the
gas accumulates. The walls are thinned as the distension goes on in the
chronic forms, but may, where the obstruction is at the pylorus, be thickened in
order to increase the expulsive force of the organ. The obstruction at the pylor-
us may be due to malignant growths either in the organ or external to it, or
benign growths in similar areas.

Tumors of the stomach are both simple and malignant, the most common
being of the malignant type. The malignant growth most common is the can-
cerous variety and may be any of the forms which we have already referred to.
The epithelial cancer made up of cylindrical cells is probably the most com-
mon, although some seem to think that the encephaloid or medullary type is
more common. The characteristics of these growths are similar to one in any
other area of the body, any modification being simply one of relation to this
particular organ. The greatest number are situated at the pyloric orifice and
may develop in the mucous membrane and form a tumor in the inside of the
stomach, the mucous membrane breaking down the result of the pressure and
forming an ulcer, or the tumor may remain pressing into the stomach without
any ulceration, or in some cases the growth seems to consist simply of a thick-
ening of the walls, which may be more or less involved. The cardiac end
being affected would necessarily tend to the contraction of the organ seeing
that the food is obstructed in its passage into the stomach and consequently

the whole of the body, as well as the stomach is imperfectly supplied with nutrition, on the other hand if the pyloic end be affected the organ becomes dilated as the contents of the organ are accumulated and undergo decomposition and the formation of gas, all of which make the stomach more feeble and more likely to dilate.

The other tumors of the stomach are sarcomata occasionally, more commonly the simpler forms of connective tissue growths, such as fibromata, myomata, adenoma and papilloma

THE INTESTINES are the seat of a great many different forms of disease. We must bear in mind the fact, that the alimentary tract forms one continuous tube, from the mouth to the rectum and having its walls in continuity throughout.

Inflammations affect the intestine in any part of its course. It is common to distinguish between the inflammations of the small and large intestine, there being some differences in structure which influence the form of the disease. The acute variety may be along with an attack of gastritis, cholera morbus, or a general inflammation of the intestinal tube. The results are swelling, redness and increased secretion. If chronic it is usually in association with some chronic disease and results in thickening of the walls with altered secretion. Sometimes there is a suppurative variety and at others a croupous. The glands may be involved, in that case it is follicular. The large intestine is affected, very often, either by an acute or chronic inflammation, which is commonly spoken of clinically as dysentery, it may affect any part of the tube, usually the lower part of the colon and the rectum. The acute form may result in exudation, and infiltration of the tissues around with inflammatory cells, an increase in the production of mucous, which passes away in the stools and some hemorrhage; or, it may be, that pus is formed in abundance in addition to the above symptoms and, terminating in ulceration or a more chronic condition with some thickening. The condition is sometimes diphtheritic and in that case the membrane may be thrown off as a complete cast of the bowel.

That special form of inflammation, which has given so much information to everybody, and which is spoken of as appendicitis, must be considered somewhat closer, not that the inflammatory process is different, but simply for the reason that it is requisite that it is clearly understood. The vermiform appendix is a small, elongated structure in contact with the colon and consisting of tissues similar to the rest of the alimentary tube. It is variable in length, with a small opening in the center about the size of a small quill guarded by a valve. The disease is usually considered to be due to the lowering of the vitality of the structure in some way, such as might be the case if foreign bodies gained an entrance into the tube, or if some injury or inflammatory condition spread to the part and caused the occlusion of the tube and allowed the micro-

organisms to develop. It is claimed, that it can take place only when the lumen of the tube is obstructed. The result of the inflammation is an effusion into the tube, infiltration of the tissue with cells, either remaining in this condition and becoming absorbed, which would be a simple form; or the inflammatory exudation increasing until the suppurative stage is reached, the pus being either in the walls of the tube or in the tube itself; or the whole of the appendix may become gangrenous and slough off, or local perforations take place. Some writers claim to distinguish between inflammations of the inner layer, the middle, or the outer layer of the musculo-membranous tube, but in cases where there are marked inflammatory changes, these affect all of the parts of the tube and even the parts adjacent to the walls.

Ulceration may exist in several different diseases and it is natural to refer to them in association with the name of the particular disease. The typhoid ulcer is found in the ileum over the agminated glands or the patches of Peyer. The follicles becomes swollen and elevated, the tissues around being infiltated. The inflammatory process is the result of the bacillary infection, being acute and specific, necrosis takes place, followed by sloughing and then we have the ulcer. The sloughing and necrosis sometimes extends sufficiently deep to perforate the wall of the bowel, and if it so happen that in doing so a fair sized blood vessel be encountered, we have hemorrhage. The ulcer is usually oval in shape, with its long axis in the line of the bowel. The edges of the ulcer are somewhat irregular, sometimes under one word minced; the base, if the slough has separated, is smooth.

Tubercular ulcers are quite common in cases of tubercular diseases. In this case, also, the ulcerated area corresponds to the glandular structures. The ulceration is the result of the implantation of the tubercle bacillus, either as a primary, or secondary infection, and the production of the changes associated with the tubercular process. The caveation and necrosis being in the tissue just underneath the mucous membrane, ulceration speedily follows. The edges of the ulcer are irregular, caseous and with tubercles around them; the base more or less roughened with tubercles in it. The long axis of the ulcer is transverse in relation to the bowel.

A duodenal ulcer is also recognized. It is found in association with severe superficial burns and is frequently referred to as Curling's ulcer. The significiance and cause of the ulcer is still obscure, but the pathological characteristics are similar to the simple or punched-out ulcer of the stomach.

We have a few specific lesions of the intestine. Cholera is an acute serous inflammation of the mucous membrane due to the bacillus of cholera. Tuberculosis is also a specific lesion due to the bacillus and usually results in ulceration, as above described, but may exist as a general miliary tuberculosis without any ulceration. The typhoid condition has been referred to also, but only in reference to the ulcerations. It may exist as a general inflammatory

affection of the mucous surfaces without any, or along with, the special ulceration of the disease.

It is common to speak of obstruction of the intestine and as this may be produced by a great many different pathological conditions, we may group them all together. The commonest of all causes, perhaps, is the formation of fibrous bands, the result of an old inflammatory exudation extending between the parts of the intestine, or the abdominal walls and becoming somewhat stretched so that a portion of the bowel readily gets caught and compressed by them. The compression being sometimes acute, producing gangrene of the part inclosed, or more chronic, in that case the accumulation of fecal matter may be slow and the condition long continued before terminating in death or being recognized. The obstruction may result simply from the twist of the bowel on itself, getting into an opening in the mesentery, being caught by an elongated mesentery, or from accumulation of fecal matter, the mention of the condition being enough to describe the pathology associated with it. Another prominent cause of obstruction, particularly in childhood, is the invagination of one part of the bowel into the part below, or as it is termed intussusception. There may be a very small portion of the bowel involved, or as sometimes happens, several feet of the intestine may be invaginated. The region of the ileocecal valve is the part most frequently affected, although it may take place anywhere in the intestinal tube. The initial cause in the production of the condition is some form of paralysis of the tube, so that the part above, enters the dilated portion and is gradually carried further by the peristaltic action of the intestine.. It is necessary to consider the state then existing— one portion of the intestine passes into another, the tube still being in continuity, leaving as a consequence, the mucous surface of the outer wall in contact with the mucous surface of the entering portion, and the entering portion, consisting of a double thickness of normal intestinal wall, leaves the two peritoneal surfaces together and the mucous surfaces separate. In other words, if we make a section through the part involved, we cut through three distinct thicknesses of the normal intestinal wall in close apposition before we reach the center of the mass. This is important to understand seeing that the pressure sometimes causes the death of the invaginated loop by sloughing, the death of the patient may be prevented by the union of the two peritoneal surfaces at the seat of invagination, just like the union in case of an intestinal resection. Hernia, or the protrusion of part of the contents of the abdomen may also cause obstruction. The pathology of hernia consists in the passing through some opening, either normal or abnormal, of more or less of the intestine enclosed in a dilatation of the peritoneum and the normal structures met with in its passage, and the changes which the intestine undergo in its new position. Some of these changes are adhesion, thickening and it may be, strangulation of the part, by the constriction at the neck of the opening.

Dilatation of the intestine results from any cause producing partial obstruction, such as chronic constipation, muscular atony, tumors simple or malignant.

Tumors may be either simple or malignant. They are most common in the region of the colon or rectum. The simple are papilloma, myoma, adenoma and fibroma. The malignant are mostly cancerous, usually the cylinder celled or squamous at the rectum, but the scirrhus variety is sometimes met with.

THE PERITONEUM. The peritoneum is a serous membrane and as we have already described the inflammatory changes taking place in the serous membranes (see the pleura) it is enough to say that we may have either acute, chronic or tubercular forms to deal with. It is worthy of note however, that inflammations of the peritoneum are rarely ever a primary condition, but are secondary to some other condition, this being well illustrated in septic conditions.

Tumors of the peritoneum are not uncommon, particularly is this the case in regard to the cancerous condition, which is frequently established as the result of infection from the abdominal organs. These secondary infections produce a disseminated disease, which may include the greater part of the peritoneal surface. It is interesting to note the relation between the peritoneum and the pleura, in these cases the cords of a cancerous nature are found to pass through the diaphragm in the lymphatic spaces and communicate with the pleura directly.

DISEASES OF THE LIVER.

The liver is a very large gland and functionally active, so that we require to consider carefully anything which may alter or impair the organ. Its structure in the normal state has to be kept in mind when making reference to the abnormal.

A very common form of disease to affect the liver is congestion, or as it called, hyperaemia, in this case passive, that is to say, is the result of any obstruction to the flow of blood, which may result in the accumulation of it in the organ. It is present in chronic valvular disease of the heart or pulmonary obstruction. The liver enlarges and it becomes extremely red in color, so much so, in fact, that the term red atrophy is sometimes applied to it. The obstruction of the blood results in the dilatation of the vessels at the center of the lobule, which remain filled with blood and the pressure exerted by this blood produces an atrophy of the hepatic cells in this area. An increase in the connective tissue around and the tendency to the infiltration of fat gives the organ the peculiar color which is characterized by the term "nutmeg liver." In addition to these characteristics, pigment granules are often found in the structure. We may have an acute form of congestion, as well as this chronic variety. It may arise from any cause which produces an over

distension of the organ with blood, such as may arise in cases of acute febrile conditions. A form of congestion is said to take place normally after the ingestion of food and some think in diabetes.

Inflammation occurs either as an acute, chronic or suppurative condition. The acute form is rare without suppuration, but it does exist, particularly in tropical climates. The characteristics are similar to any other acute inflammation.

Chronic inflammation, or as it commonly called cirrhosis, is much more common than the acute variety. There are several different forms recognized (1) atrophic cirrhosis which is associated with alcoholic conditions, syphilis, malaria and some other diseases. The liver becomes considerably less in size, more fibrous, and rough on the surface, it must be understood that in the early stages the liver is enlarged. It is the rough appearance which has given rise to the term hob-nailed liver. On section the organ presents a mottled appearance to the naked eye which is due to the extra development of fibrous tissue and the atrophy of the hepatic tissue, it is to be distinguished from the nutmeg liver which is the result of congestion and not a development of fibrous tissue as in this case. The connective tissue in the organ is greatly increased, the contraction of which presses upon the hepatic structure and it atrophies then the organ becomes less in size. The portal circulation is obstructed and thus we have the accumulation of fluid in the abdominal cavity. (2) Hypertrophic cirrhosis differs from the atrophic form in having a distinct enlargement of the organ. The surface is smooth, the edges round and the tissue quite dense and hard. The portal circulation is not obstructed, hence there is no ascites. The bile ducts are involved by the chronic inflammatory change and may be obstructed. The tissue shows a considerable round cell infiltration and an increase in the small bile ducts. (3) Another form is sometimes spoken of as fatty cirrhosis. It differs from the atrophic in having a smooth surface, and a considerable number of adipose cells in the tissue.

Suppurative inflammation or abscess of the liver may be the result of an injury, or the implantation of infected material through the circulation : in the first form, the abscess would be single. the latter there would be multiple abscesses. The pathology of the hepatic abscess is similar to that of an abscess elsewhere. There is a form commonly referred to as tropical abscess, but which might just as well be included in the infective form, seeing that it is produced by a micro-organism—the amoeba coli. It is said to have no wall, that is true abscess-wall.

Specific diseases of the liver are mainly syphilis and tuberculosis. Syphilis is a common factor in the production of the atrophic form of cirrhosis, but in addition to that, gummatous conditions frequently develop. These gumma are irregular in size, usually on the outer part of the organ and require to be differentiated from cirrhosis. They are mostly on the under surface and are

larger than the nodules in cirrhosis, they are composed of true gummatous tissue. The lobulated liver is a form of syphilitic disease where the fibrous structure forms bands, the contraction of which produces the appearance peculiar to the condition. The organ is contracted. Tuberculosis of the liver is mostly of the miliary type being set up by the distribution in the organ of the bacilli through the circulation.

Retrograde changes are either of the nature of an infiltration, a a degeneration.

(1) INFILTRATION. Fatty infiltration is a condition very often present in cases where there has been some interference in the normal process of tissue metabolism, as in chronic forms of disease such as tuberculosis. The organ is considerably increased in size, soft and oily. The structure of the tissue altered by the infiltration of the hepatic cell with globules of oil. The zone affected, primarily at least, is the margin of the lobule in the region of the portal vein. Albuminous infiltration consists in the infiltration of the hepatic tissue with this albuminous material. The liver is smooth, soft, harder than normal, and pale in color. Infiltration of the liver with pigment is quite common in malarial conditions and is probably due to the fact, that the organ is congested at each rise in temperature and is then subjected to the decolorizing process which high temperatures always produce. The pigment may be in the tissue, or still within the blood vessel. The organ is enlarged in life, but after death diminished, on account of the blood passing out and leaving the tissue shrivelled, easily distinguished from an ante-mortem contraction. The color of the liver varies very considerably, it may be light or dark. Another form of pigmentation is met with where there is a deposition of the pigment in the tissues around the portal vessels, carried there, according to Weigert, by the blood cells and deposited in the tissues. In cases of jaundice the hepatic cell may be more highly colored than normal with the biliary coloring matter.

(2) DEGENERATIONS. The febrile state is always associated with a granular condition of the organs, or as it is called, parenchymatous degeneration of the organ. The liver is similarly affected and results in a granular condition of the hepatic cells, and an increase in the size of the organ. These changes may pass away, or may lead on to a true fatty degeneration, in fact, it is claimed by some, that it is simply the initial stage in the process of fatty degeneration. Fatty degeneration consists in the transition of true hepatic cells into fat cells. Amyloid degeneration produces changes in the liver, which depend so far as the naked eye is concerned, upon whether the liver is normal or cirrhotic, which it often is. The disease begins in the walls of the intra-lobular vessels rendering them translucent and by their thickness causing atrophy of the hepatic cells. The disease is nearly always general, that is, some of the other organs of the body are affected, such as the kidney or spleen.

A very serious form of degeneration, sometimes met with, is spoken of as acute yellow atrophy of the liver. The organ undergoes very rapid diminution in size, within two or three days shrivelling up as much as half and the remainder being in a semi-fluid condition. The reason for the condition does not seem to be at all apparent, but some regard it as a specific condition, others that it is a form of acute inflammation of the liver. The structure of the tissue may be altogether altered, the hepatic cells disappearing, a mass of granular matter, oil globules and pigment remaining. The crystals of leucine and tyrosine are found in the blood, in the liver and the urine, but their significance is not clear. (See Urinary deposits.)

Tumors of the liver are either of a primary or secondary nature, simple or malignant, the latter being most numerous. The simple forms met with are adenoma, fibroma and angioa, the malignant, carcinoma and very rarely sarcoma. Cancer affects the liver as a secondary condition, for the most part being conveyed from some of the other abdominal organs. The disease is distributed somewhat irregularly in the tissue usually in larger or smaller nodules, sometimes affecting the whole of the liver and immensely increasing its bulk, so much so that we have seen cases where the lower margin of the organ extended below the level of the spine of the ilium. The variety depends on the primary lesion, being similar in type to that from which it originates. The primary lesion in the liver is usually of an epitheliomatous nature, many looking upon it as orignating in the blue ducts.

There is a condition, usually spoken of as parasitic disease, where cysts develop around the parasite and enclose them. The whole of the organ is healthy with the exception of the part affected by the cyst. The cyst may be single or multiple, with a definite wall formed of connective tissue, upon which lies the soft and gelatinous lining derived from the germs, and within which may be found the small parasites and at times small cysts. The contents of the cyst are fluid, with cysts, embryo or broken up parasites, with granular debris floating in it, There are several forms of parasites which attack the liver, the most common being the echinoccous, better known as hydatids of the liver.

THE BILE DUCTS AND THE GALL BLADDER.

The bile ducts and gall bladder are subject to the different forms of inflammation that the other structures are. The term cholecystitis is applied to the inflammation of the bile passages. The acute from of inflammation leaves very slight trace of its presence but the mucous surface is usually swollen, the vessels dilated and quantities of mucous accumulated. The chronic variety is followed by thickening and obstruction. The suppurative form has purulent or semi-purulent material distributed over the mucous surface, or it may ulcerate, which is commonly the case if gall stones are present. All these forms are likely to produce obstruction. Obstruction is al-

most always present in all affections of the passages, whether of an inflamma-
tory nature, or simply pressure from external causes such as tumors of some
of the organs adjacent, and gives rise to dilatation either of the gall bladder
or of the bile ducts.

The formation of gall stones is very common, they are usually found in
the gall bladder, sometimes also in the common duct, or bile passages and
may be either single or multiple. They are frequently found post-mortem
without having any indication of their presence during life. The multiple
condition is the most frequent, the stones being in that case facetted, that is
having several surfaces the result of the constant pressure of the one against
the other, and may be present in any quantity from one to several hundred,
of any degree of size varying from a small pea to a man's hand. The single
form is usually larger than the multiple and of an oval shape with smooth
surface. The stone consists of a nucleus of some kind usually mucous, bile
pigment or, although rarely, a foreign body, and surrounding this the ma-
terial of which the stone is composed, the greater proportion of which is
cholesterine. The color of the stone varies, depending upon the composition,
if a small amount of bile pigment is present then the color is lighter, if the
pigment constitutes the bulk of the stone then it is dark, in fact almost black
in some cases, it is more common to find an intermediate condition where
there is some cholesterine, some bile pigment and some of the salts of lime,
the color is lighter perhaps green, brown or with a tinge of red.

Tumors are present occasionally, chiefly of the malignant form and mainly
of the epitheliomatous character, they may be either of a primary or secon-
dary nature, in the latter case corresponding to the variety from which they
originated.

DISEASES OF THE PANCREAS.

Diseases of the pancreas have received very little consideration, proba-
bly because the function was imperfectly understood and consequently symp-
toms of the disease were obscure. It does, however, play an important part
in the function of digestion.

Inflammations—pancreatitis—may be acute, in association with febrile
diseases and results in hyperaemia, swelling and oedema of the organ. Acute
hemorrhagic inflammation frequently takes place in chronic alcoholism and
some forms of dyspepsia. The acute inflammation may terminate in suppur-
ation, the abscesses being single or multiple, and is generally looked upon,
particularly if multiple, as being infective, that is secondary to a similar sep-
tic condition in the ailimentary tract. These acute inflammations may term-
inate in gangrene, particulary the hemorrhagic form. Chronic inflammation
or cirrhosis is common, being either diffuse or localized and resulting in an
increased development of connective tissue.

Degenerations of the pancreas are frequent, for example, atrophy which

is frequently in association with diabetes; fatty degenerations; fat necrosis; amyloid or fatty infiltration.

Hemorrhage into the organ is common in injuries or diseased conditions of the blood-vessels, the hemorrhage being extensive, usually terminating in death from the pressure on the solar plexus.

Tumors of the organ are mostly malignant and mainly carcinomatous. It may be primary or secondary, the schirrus form being most common as a primary condition, any form may be present as a secondary growth. It, mainly, affects the head of the organ. Cysts sometimes develop simply from the pressure upon the duct, obstructing the flow, the pressure being either within the pancreas, or from structures adjacent to the organ. Their shape and size vary, depending on the quantity of fluid within. Concretions sometimes form, white or grayish white in color, medium size and consist of the salts of lime, in some cases they may be as much as an inch in diameter.

DISEASES OE THE SPLEEN.

The spleen being closely associated with the blood circulation, frequently manifests conditions due to some deficiency in the circulatory process Hyperemia of a passive nature always takes place when obstruction to the portal circulation exists, or in lesions of the heart. At first the organ is soft and enlarged, later it is harder, the trabeculae becoming thickened. Infarctions are common, the result of emboli in the blood, and produce the typical wedge-shaped areas of the condition. The emboli may be simple or infective and give rise to the train of symptoms referred to in the paragraph on infarction.

Inflammations are of the usual type. The acute giving rise to swelling, softening and sometimes proliferation of cells. This is frequently found in the specific fevers, and in the case of the scarlatinal infection, the increase in size is very great. In these cases the swelling is supposed to result from infectious emboli, frequently setting up multiple abscesses, in that case being a suppurative inflammation. Suppuration may take place also from other causes, such as abscesses in the kidney, or in the organs adjacent, and may be either minute or else of considerable size. Chronic inflammations result in an increase in the connective tissue and are illustrated by the ''ague-cake'' or enlarged spleen associated with chronic malarial poisoning. In these chronic forms the capsule is thickened and the cells pigmented, the whole organ being darker in color. Specific inflammations are met with. We may have a syphilitic inflammation with a chronic thickening, with or without the syphilitic gumma. We may have a tubercular inflammation, secondary to a tuberculosis elsewhere, or as a general miliary tuberculosis, the tubercules being small, extensively distributed in the substance of the spleen and undergoing the necrotic changes of tubercules generally. A form of inflammation is often referred to as a perisplenitis or inflammation of the capsule, the whole

or a part of it being involved. It appears as an acute condition along with a general peritonitis, sometimes suppurating and with the changes associated with these conditions. It may be chronic, lesser or greater areas of the capsule becoming thickened and probably adherent.

The degenerations of the spleen are very common. It may simply undergo an atrophic change, become smaller, harder, lighter in color and the capsule wrinkled. This happens in persistent anaemia, in senile conditions and frequently when no cause can be assigned. Hypertrophy takes place, for example, in leukemia and pseudo-leukemia, the increase being partly a hyperemia and partly an increase in the cells and the pulp. The spleen-cake of malarial fever already referred to is not considered a true hypertrophy.

The most common of all the degenerations in the spleen is what is generally referred to as "sago spleen," it is one of the forms of amyloid degeneration. The part affected is the malpighian body which assumes the clear, transparent appearance, characteristic of amyloid disease. It is probable that the disease at first attacks the blood vessels and later the tissue around the vessel which constitutes the malpighian body. These affected spots may be small, or large enough to meet one another. Sometimes the pulp is involved in addition to the malpighian body. If the pulp and the trabeculae become affected the condition is spoken of as diffuse. Pigmentation sometimes takes place, the coloring matter of the blood being deposited, or it may be that the pigment is from other organs, as in anthracosis.

The tumors of the spleen are rare, but if present may be of the nature of an angioma or lymphangioma, sometimes fibrona, or if malignant, sarcoma, very rarely carcinoma. The sarcoma is mostly of a secondary character and is circulated by the blood stream. Cystic tumors are comparatively common resulting from an unabsorbed infarction or of parasitic nature.

DISEASES OF THE LYMPHATIC GLANDS AND VESSELS.

The diseases of the lymphatic glands are mainly of a secondary nature due to the passage of material through the lymph stream. This is well seen in the inflammatory disturbances to which the gland is subject. The acute form is associated in nearly every instance with an inflammatory affection of the part from which the lymphatic vessels pass to the gland or chain of glands involved. The acute inflammation produces a considerable increase in the size of the gland, due partly to the increased vascularity of the structure, but due also to the proliferation of cells which accumulate in the sinuses and probably also from the cells of the blood. The gland is soft, perhaps diffluent. The condition may pass off, but is more common to spread to the tissues around the gland, setting up a periadenitis. particularly, is this the case, when the cause is absorption of septic products, and nearly always in these cases suppuration follows, then we have a suppurative inflammation to deal with. In some cases the inflammation terminates in gangrene. Chronic

inflammation results in the formation of connective tissue in all the connective tissue structures in the gland, going so far, in some cases, that the whole gland becomes fibrous, the glandular portion having been destroyed by the pressure of the new formed tissue. There is a form of inflammation where the gland becomes more or less caseated, and this apart from the caseation found in cases of abscess where the contents are retained and the fluid absorbed so that the dry calcareous matter remains encapsuled. In this case the gland is enlarged, with an increase in the cellular elements and sometimes the stroma also, with larger or smaller areas of necrosis. The condition is usually referred to as scrofula and affects the glands of the neck, chest and abdomen, but would probably be more correctly described as tuberculosis. The objection to the term tuberculosis being that no tubercules or bacilli are present, or at least seen, but the caseous necrosis is rather typical of the condition.

The tubercular form of inflammation of glands has already been referred to in a general way (see tuberculosis.) It is necessary, however, to say that the glands of any part of the body may be affected particularly those which communicate with parts easily reached by the tubercle bacilli. The glands of the neck are frequently invaded by the bacilli travelling from the mucous surface of the nose, throat or mouth, the mesenteric glands from the gastro-intestinal surfaces. The bacillus on reaching the gland sets up an inflammatory condition which is characterized by the proliferation of cells, both glandular and endothelial, the new cells being of an epitheloid nature, either with or without the giant cell. These areas of cells run together, caseate and remain encapsuled, or they break through the capsule, reach the surface and continue as discharging wounds.

Syphilis sets up inflammatory changes in the glands connected with the initial sore, the changes in that stage being similar to an acute inflammatory process. The secondary stage is characterized by the enlargement of the glands in other areas distant from the original seat of infection, becoming increased by an overgrowth of the connective tissue and the accumulation of cells of different shape within the gland. There is very little tendency to suppuration, remaining simply hard or becoming absorbed in course of time. In the tertiary stage the tendency is to the formation of the gummatous tumor.

The lymphatic glands are subject to degenerative changes in addition to those just mentioned, which might be correctly classified degenerations instead of inflammations, but they are not very common or important. Atrophic changes are met with usually as a senile condition, the gland becoming smaller, harder and mainly fatty. Amyloid degeneration affects the glands either in association with the general condition or by itself, the reticular portion being involved along with the smaller blood vessels. The hyaline form of degeneration sometimes occurs affecting the walls of the blood vessels in the

gland, and the lymph cells, the affected parts being swollen and clear, and distinguished only from the amyloid condition by the reaction to chemical reagents. Pigmentation of the glands is common, seeing that anything of that nature in the tissues may be carried through the lymph stream and become deposited in the substance of the gland. This is well seen in cases where there has been tatoo marks made on the surface of the body, the particles of pigment lodged in the glands adjacent.

There is a peculiar form of enlargement of glands to which different terms have been applied, to a great extent depending upon the view of the individual when speaking of it. The gland becomes greatly increased in size and frequently soft, the increase being in many cases of a glandular nature, in others the glandular structure being hardly perceptible. The disease may effect one gland or many. It is common to look upon the condition as being of the nature of a malignant growth and that of a sarcomatous type. They are spoken of as lymphomatous glands.

Tumors of glands may be either simple or malignant, the latter being most common. The simple are chiefly fibromata, the malignant, either sarcoma or carcinoma, the latter nearly always secondary, the former either primary or secondary. If we consider the enlargement just referred to as sarcomatous, then the sarcomata are mainly primary, they may be of any of the forms already mentioned—round, or spindle celled—the lymphoid enlargement being hard to distinguish from the small round cell type. The cancers conform to the type of the primary lesion, if itself primary, it may be an endothelioma although this is rare.

THE VESSELS. The diseases of the lymphatic vessels are not unlike the diseases of the other circulatory vessels, that is the blood vessels. They are, perhaps, more subject to inflammations seeing that the inflammatory condition is nearly always the result of some septic product passing through them, in other words the infectious material is carried from the surface, through these vessels, and as it passes it sets up the inflammatory changes which at the outset are usually swelling and proliferation of cells, later suppuration, or it may be, if the inflammation is moderate, that thrombosis and obstruction takes place. The inflammation is usually of the acute type, but in some cases may be more chronic, as is exemplified by the disease known as elephantiasis which is said to result from the thickening of the walls of the vessels with inceease in the lumen as the result of dilatation, along with the thickening in the connective tissues around. The acute inflammations of the cellular tissue under the skin and the skin itself, spoken of as erysipelas, are considered by many to be due to the infective inflammation of the lymph spaces in the cellular tissue.

Dilatation of the vessels is frequently met with, usually as the result of some obstruction in the smaller vessels or else in the main channel: sometimes

it results from weakness and is illustrated by the condition already referred to as elephantiasis. The result is the accumulation of the fluid in the vessels giving rise to swelling, or it may be that the vessels rupture and empty their contents into the surrounding parts, as in chyluria where the fluid is thrown into the urinary tract, or if accumulated giving rise to such conditions as the macroglossia or lymph tongue.

The thoracic duct is the main channel into which all the lymphatic fluid flows, before it enters the general circulation and differs only from the other vessels in size. On account of its size, the diseases which affect it are considered more in detail as a rule, but they differ very little, if any, from the diseases to which the vessels are subject. It is easy to see that the obstruction and consequent dilatation of the duct would set up a more general obstruction to the flow and therefore a greater amount of swelling would be met with, that being only a question, however. of the point of obstruction and not the nature of the obstruction. Further, it is easy to understand that the inflammation may be the result of a more diffuse absorption seeing that the greater part of the tissues of the body drain directly into the thoracic duct. The same might be said of the dilatation, that it can be produced readily by pressure, in many cases from cardiac lesions.

The specific affections of the vessels may be either tuberculosis or syphilis, the former much more frequently than the latter. The tubercular condition is well seen in the case of a general intestinal tuberculosis, the vessels affected showing the lesion in radiating lines from the seat of the inital lesion.

Tumors of a simple nature are usually speaking very rare, the malignant variety being mainly cancerous and of a secondary character. The form spoken of as endothelioma is sometimes met with, it being produced simply by the increase in the cells lining the inner wall of the vessel.

It is quite common to find the vessels distended as the result of parasites, either adult or embryonic, getting into the circulatory passages.

DISEASES OF THE THYROID GLAND.

The thyroid gland is one of those glands which is referred to as a "ductless gland," but it must be borne in mind that it is only in adult life that this is true, for in the early foetal life it opens at the base of the tongue, and contains for the most part some colloid material as a natural condition.

Inflammation of the gland is not very common but may occur in several different forms, either as an acute condition in association with some infectious disease, such as typhoid fever, the inflammatory change being mainly one of enlargement, passing off readily, and, for that reason, supposed to be simply vascular; sometimes it terminates as an abscess but this is more common in cases where it is in association with such diseases as diphtheria, endocarditis, or some pyaemic condition. Tubercular inflammation is characterized by the formation of miliary tubercles and is rare. Syphilitic inflamma-

tion is also rare but may be present, and if so gummatous tumors are formed. Chronic inflammation results in newly formed connective tissue and is rare. Degenerations are frequent, particularly that form spoken of as colloid where the alveoli of the gland become filled with this peculiar form of material. Other forms of degeneration are amyloid, which affects the blood vessels chiefly, and hyaline which affects the stroma. There is a form of degeneration associated with hypertrophy to which the term goitre is most frequently applied. In this form the glandular tissue becomes increased in size, retaining in some cases its normal condition of softness, in others becoming almost entirely fibrous; sometimes the spaces within the gland become increased and filled up with the colloid material, these are frequently spoken of as colloid goitres or sometimes cystic goitres, on the other hand, the firmer form is spoken of as fibroid goitres. Another form is recognized which might be considered a hyperemic condition but has in addition to the hyperemia some hypertrophy, it is spoken of as vascular goiter, the size being sometimes enormous and is an accompaniment, if not the esssential condition, of Graves' disease. Secondary changes may take place in these structures becoming calcareous, undergoing ossification or other degenerative changes.

The general effect of disease of the thyroid is the production of myxoedema, which is a peculiar condition approaching in appearance to an ordinary oedema, but differing from it in that the tissues do not pit on pressure and the fluid within the tissues being of a gelatinous nature. The skin is dry and pallid and eventually evidences of mental deficiency present themselves. These symptoms are all more or less present in cases of excision of the thyroid.

In Graves' disease, which, as has already been indicated is a vascular goitre, there is nearly always proptosis or protrusion of the eye-ball along with functional disturbance of the heart, the term ex-ophthalmic goitre being sometimes applied to the condition.

The tumors are nearly always primary and may be either simple adenomata, or either of the two forms of malignant disease.

DISEASES OF THE SUPRA RENAL BODIES.

These are two small bodies or capsules situated above to the kidneys, and belong also to that type of glands spoken of as the "ductless glands;" they are subject to several different forms of disease.

Inflammation is rare but sometimes presents itself as a suppurative condition in cases of pyaemia, or in cases where some other form of disease precedes the abscess. The specific inflammations are more common, particularly the tubercular, which is characterized by the development of tubercles and a considerable quantity of caseous matter, the gland itself being increased in size and more or less fibrous. The syphilitic inflammation occurs somewhat rarely and is usually associated with gummatous tumor.

Degenerations are principally fatty, which, so long as it affects only the cortical area, is considered normal in the adult, but if it travel further or affect the child it is considered pathological. Amyloid degeneration is mostly present along with general amyloid disease. It affects the blood-vessels primarily and the cortex more frequently than the medullary portion. Pigmentation of the medullary portion is frequent in the aged.

The tumors may be either primary or secondary. They are most frequently malignant, the sarcoma being most common. Gliomatous tumors have been described; they are, as already indicated, quasi-malignant and it is doubtful if they are frequent in this location. Neuromata are also spoken of.

The general effect of disease of the supra-renals is the production of the disease spoken of as "Addison's Disease." The disease is characterized by the development of patches of pigmentation on the skin, the mucous membrane and in association with this, general weakness and debility. The supra-renal bodies are in the state of fibro-caseous tuberculosis usually, but not necessarily so, seeing that tumors sometimes produce the same result and in fact the same general result (that is Addisonitis) may be present without any trace even of disease of the supra renals.

DISEASES OF THE KIDNEY.

The kidney being a very active gland is subject to diseases of different forms. The study of the diseases of the organ depend upon a correct knowledge of its structure and function. It consists of masses of tubular glands, lined with epithelium of somewhat different characteristics, arranged together so as to form the complex body known to us as the kidney. Between the tubules there is connective tissue, and surrounding the organ there is a fibrous capsule. Its function is to carry away waste products from the blood.

Inflammations of the organ are common and of different forms. Acute inflammations are recognized as involving either the parenchyma or glandular structure of the organ, or the interstitial or inter-tubular portion of the organ. These inflammatory conditions may result from overwork of the organ, or from the passage through the tubules of some irritant. In the parenchymatous form the change consists in an alteration in the epithelium lining the glomeruli or the tubules, or both of them at the same time. The epithelium becomes granular and generally terminates in fatty degeneration. Sometimes the inflammation is hemorrhagic, that is to say, there is a tendency to the extravasation of blood. There is more or less of a proliferation of the connective tissue between the tubules. The inflammation and its changes give rise to the casts found in the urine in those cases and which will be referred to among the urinary deposits. The acute interstitial inflammation is nearly always suppurative following some general suppuration and the circulation of the infective material giving rise to small emboli. These are mostly found in the small vessels around the glomeruli and may simply consist in

minute specs, or there may be considerable infiltration around the embolism. These may form larger or smaller abscesses and may terminate by opening into some of the organs or spaces adjacent, or pass through the urinary tract. What is usually spoken of as suppurative inflammation, is an inflammation of the pelvis of the kidney from some cause or other, perhaps the formation of a calculus, the continued irritation resulting in the formation of pus. Chronic inflammation may either involve the parenchyma, or the tissue between the tubules. In the former the kidney is somewhat enlarged, the capsule easily removed, the tubes are more or less distended with granular or fatty cells and at a later stage lose their epithelial lining. The kidney as a whole in the later stage of the disease contracts, then the capsule is probably adherent. The interstitial form is practically a continuation of the condition referred to in the later stages of the parenchymatous form, but may take place without being preceded by parenchymatous changes The organ is small and irregular, the capsule being adherent. The structure of the kidney is altered, there is an extra development of tissue between the tubules which results in compression of the tubules and may give rise to cystic dilatations of these tubules at different points. Sometimes chronic inflammation of the interstitial type is referred to by terms indicative of its causation, for example, gouty nephritis. The kidney being found in different stages accounts probably for the differences in opinion regarding its size under different conditions.

The specific inflammatory conditions are (1) tuberculosis in which the whole organ may be converted into caseous nodules, or there may be a diffuse miliary tuberculosis. (2) Syphilis which is mainly found as gummatous tumors or as scars resulting from the gummatous condition.

DEGENERATIONS. Amyloid degeneration is an accompaniment of general amyloid disease. The organ is larger, harder, translucent and the capsule is readily removed. The blood vessels of the glomerulus are first involved, their walls becoming thickened, afterwards the vessels of the tubule are involved. Fatty degeneration is nearly always associated with parenchymatous inflammations and consists simply in the structures becoming fatty and accumulated in the tubules. Cystic degeneration is frequently met with and may result from contraction of the kidney substance, the impaction of calculi, or the inflammatory changes taking place in the pelvis of the kidney. There is a condition spoken of as cystic disease, which is supposed to depend upon some fault of development, in fact congenital cystic disease of the kidney has been sufficiently extensive in some cases as to form a barrier to the birth of the child.

The formation of the cysts results in the formation of the saccules or dilatations of the tubules and provided the fluid is watery it is spoken of as a hydro-nephrosis, if purulent it is a pyo-nephrosis.

Circulatory disturbances are not uncommon. There may be what is

spoken of as congestion of the kidney seen in cases of obstruction to the circulation generally, as in heart lesions, this is a passive condition, the tissues becoming more or less indurated, the epithelium becomes granular and sometimes fatty. An acute congestion is sometimes noted in febrile conditions, or where irritant poisoning has taken place; the change consisting in engorgement of blood, with dilatation of the vessels, sometimes extravasation of blood and sometimes the epithelium becoming granular. The hemorrhagic infarction which has been already described in general terms, frequently involves the kidney and all that need be said in further describing the condition, is that a certain amount of the functionally active kidney structure becomes impaired.

There is a condition which has been spoken of as infarction of the kidney which consists simply in the accumulation of certain materials, for example the urates, in some of the tubules giving rise to an obstruction of that portion involved. It is seen in gout, some forms of bone disease and in the jaundice of infancy.

Tumors of the kidney may be either simple or malignant. Fibroma, lipoma and a peculiar form of muscular tumor spoken of as a leio-myoma may be met with, the simple adenoma being rare unless as a congenital type. Sarcoma is the most common malignant tumor and is said to occur even as a congenital condition. Adeno-sarcoma is frequently met with. Carcinoma is rare as a primary condition but is not uncommon as a secondary.

Parasites of the kidney are of moderate frequency and may result in the formation of cysts as in the echinococcus, the waxy appearance of the kidney in chyluria, or the inflammation of the pelvis of the kidney in some of the other forms. The appearance of the kidney in chyluria is due to the obstruction of the lymphatic spaces by the filaria sanguinis, either as an adult or as an embryo.

Malformations of the kidney are not uncommon, taking on some of the types of the lower stages of life, in other words, returning to a more simple form. The horseshoe kidney is a malformation supposed to be caused by the union of the two kidneys. The kidney may be found in almost any position in the abdominal cavity and then is spoken of as movable; this is not strictly a malformation, simply a mal-position possible by reason of the length of the ureters. It has been found in the pelvic cavity.

Surrounding the kidney there is a considerable quantity of cellular tissue which becomes affected by inflammatory changes and if acute usually terminates as an abscess, the condition being spoken of as a perinephritic abscess. The pathology being simply the formation of the abscess.

The capsule of the kidney is subject to inflammatory changes of the different forms and is spoken of as a perinephritis.

DISEASES OF THE URETER.

The pelvis of the kidney, that is the cavity into which the apices of the pyramids open, communicates directly with the musculo-membranous tube or the ureter, and this passes directly into the urinary bladder. The mucous membrane of either of those parts, that is the pelvis of the kidney or the ureter, may be irritated and terminate in some form of inflammation, the inflammation probably being in association with inflammatory changes in the general urinary tract. The inflammation of the pelvis has already been referred to, resulting from the irritation of calculi, then, it is usually associated with the formation of pus; but it may occur apart from this condition and in that case it is usually catarrhal, that is to say, there is proliferation and desquamation of the epithelial cells. The inflammation of the ureter is mainly of a catarrhal nature, the walls becoming swollen and the cells desquamating with some tendency towards the formation of superficial ulcers. Chronic inflammation of either of those parts results in thickening. Tuberculosis sets up specific changes in either or both of these regions which consist in the formation of caseous nodules or of a miliary tuberculosis.

The tumors in this region are rare but there may be cancerous formation in association with a primary cancer of the kidney or bladder. Small cysts are sometimes present in connection with the ureter.

DISEASES OF THE BLADDER.

The urinary bladder is a musculo-membranous sac into which the ureters open. It is affected by all the forms of inflammation to which mucous surfaces are subject. Inflammation of the bladder is spoken of as cystitis, the other terms applied distinguish the form of the cystitis. Acute cystitis is usually the result of an injury, such as the irritation of a calculus, or infection. The mucous membrane becomes swollen and congested, with mucous covering its surface and, if particularly acute, separation of shreds of epithelium. The condition may be a catarrhal one when there is a considerable proliferation of cells, partly purulent then there is the formation of pus or it may be ulcerated in that case being due, usually, to the decomposition of the urine in cases of paralysis or in severe infection. There is a form of inflammation somewhat acute in character, where there is the deposition of fibrin and the formation of a membrane somewhat similar to that in diphtheria and the term pseudo-membranous or croupous inflammation is applied to that condition. Chronic inflammation is characterized by the thickening of lesser or greater areas of the mucous surface, the areas affected being lighter in color and sometimes softened. In continued inflammations there is almost always ulceration and deposition of the salts from the urine, sometimes the ulceration is extensive becoming even gangrenous. These ulcers are due to some extent to the erosion caused by the decomposing urine, but also, and perhaps, to a greater extent the communication of the small abscesses which form underneath the

mucous surface as the result of the infiltration of pus which takes place in these areas in chronic inflammations. The specific inflammations are mainly tubercular, in that case it is nearly always secondary to tuberculosis elsewhere, and is characterized by the formation of ulcers. Syphilitic inflammations are rare and are mainly of an ulcerative character.

The circulatory disturbances of the bladder are. hyperemia which may be acute following some irritation, or passive when there is some obstruction to the vena cava and producing a marked dilatation of the veins, frequently terminating in hemorrhage; or hemorrhage which may take plalce in addition to that above mentioned, as the result of an injury, where new growths are present and sometimes even very profusely in cases where considerable dis-tention existed which was suddenly removed, hence, the necessity of care in catheterizing in cases of retention of the urine. The bladder may become considerably dilated in cases where obstruction exists, resulting in paralysis of the muscular coat, sometimes in hypertrophy and sometimes in rupture. The external surface of the bladder is sometimes irregular, owing to the form-ation of saccules, these saccules being produced by the softening and dilata-tion of the whole muscular coats, or from the protrusion of the mucous coat through the muscular, in fact a hernia of the mucous coat through the mus-cular coats.

Malformations are frequent, sometimes even being external to the abdom-inal wall, the condition being spoken of as exstrophy. There are some cases recorded where the bladder was separated by a septum, and some even where it was absent entirely, the urine passing directly in those cases from the ure-ter into the urethra.

TUMORS. A form of tumor very frequently found is the soft, vascular growth spoken of as papilloma. They vary in size, consist essentially of a fibrous stroma and an outer layer of cylindrical epithelium, they are met with in chronic inflammation; sometimes they terminate as malignant growths. Malignant growths are mainly cancerous of the seconday form, resulting from an extension from some of the parts adjacent. If primary it may be any of the types of cancers already referred to.

The salts in the urine may be deposited and give rise to the so-called cal-culi, which may may be present in any number and in any size. The most common are phosphates, uric acid, urates and oxalate of lime. Calculi are formed by the deposition of these salts around some neucleus, the most com-mon neucleus being mucous or some foreign body.

The uric acid calculi more commonly originate in the kidneys and are formed from the excess of the acid in the urine, they are very frequently pres-ent in gouty subjects, they are usually small in size, reddish in color, mul-tiple and smooth; some of them are irregular on the surface. The urates are rare, as a pure urate condition. being more frequently in combination with

the acid variety. They are yellowish in color and softer. The phosphatic calculi are principally of the mixed form, or the triple phosphate or ammonia-magnesium phosphate They are large in size, rough, light in color and easily broken.

The oxalate of lime calculi are usually in combination with the uric acid or phosphate forms and they vary considerably in size. They may be either extremely small and hard, or somewhat larger and coarse. They are variable in color and are frequently spoken of mullberry calculi.

There are two rare forms of calculi met with, cystine and xanthin. The former are somewhat oval in shape, yellowish in color and fracture like crystals; the latter are also oval in shape but somewhat flattened, they are smooth and somewhat red in color.

DISEASES OF THE URETHRA.

The urethra is a membranous tube lined with epithelium of different varieties. It has a mucous surface and is consequently affected by inflammations of a catarrhal form. Acute inflammation may be simple as the result of irritation or the extension of some inflammatory condition higher up, or it may be infective. The mucous membrane becomes swollen and red, with considerable mucous deposited on the surface, sometimes the exudation is muco-purulent. The inflammation may extend to the periurethral structures and result in the formation of an abscess.

In acute inflammations it becomes necessary to diagnose the cause and in these cases examinations are made to determine the presence or absence of the gono-coccus. These micro-organisms occur in pairs or fours and may be simply in the exudation or within the pus cells. They are oval or spheroidal in shape and are recognized by their reaction to the aniline stains. A drop of the fluid is placed on a cover-glass allowed to dry and stained according to the method described as the Gram's method. Chronic inflammation is usually characterized by continued muco-purulent discharges, or there may be ulceration or induration; the latter being well exemplified in cases of stricture, which is simply a new formation of connective tissue in the wall of the urethra. The specific inflammations are either tubercular or syphilitic; the former being rare, sometimes met with in association with tuberculosis further up the tract, the latter being more common and presenting itself in the form of an ulcer.

The urethra is frequently injured, it may be as the result of catheterizing or from injury to the perinaeum by falls or fracture of the pelvic bones; it may be followed by fistulous openings. If the wounds heal there is likely to be an obstruction with dilatation of the portion immediately behind.

TUMORS. Chronic inflammation results in the formation of polypi; these bodies are frequently met with around the meatus. Cysts are formed as the result of the dilatation of the glands in the mucous membrane. Malig-

nant disease usually always presents itself as a cancerous condition, resulting as an extension from the tissues around. Primary disease is very rare but has been met with beginning at the glands of Cowper.

DISEASES OF THE FEMALE GENERATIVE ORGANS.

The generative organs being so active at certain periods in the life of the female are necessarily very liable to changes which may result in disease or actually encourage the production of different forms of diseases. It is necessary to consider all the different parts of the generative tract by themselves in order to arrive at a clear understanding of the diseases to which they are subject. The different parts to consider are the uterus, the appendages, the external parts of generation including the vagina, and the mammae.

THE UTERUS. The uterus is an organ which consists of muscular, fibrous and epithelial tissue. It is the organ in which the various developmental changes in the embryo take place, and consequently undergoes many changes in the normal conditions associated with the period of gestation, and to that extent is specially liable to many diseased conditions. Any of the different tissues in the organ may be involved in the inflammatory process and the terms applied to these conditions are such that a distinction can be made between them; endometritis signifies inflammation of the mucous membrane, metritis an inflammation of the wall, perimetritis an inflammation of the peritoneal covering and parametritis an inflammation of the tissues around the uterus.

Endometritis may be acute as the result of an infection or a complication in some infectious disease and is usually of a catarrhal nature. It is charac terized by swelling of the membrane, desquamation of the cells and considerable mucopurulent discharge; sometimes if the inflammatory process be very acute the cells may undergo necrosis. It is also found as a chronic condition in unhealthy women, in cases of chronic congestion of the circulation, and often when no cause seems to be ascertainable. In the early stage there is simply swelling and mucopurulent secretion, but later there is thickening of the tissues and this applies to the interstitial tissue and also to the glandular tissue, to such an extent may this be increased that it is somewhat akin to the formation of tumors of a glandular nature. The character of the mucous membrane may be changed almost entirely by the long continued inflammation, so much so that the columnar cells in the glands may become squamous. Occasionally the inflammatory changes result in the formation of small areas of ulceration on the mucosa.

The cervix is frequently the seat of the chronic inflammatory changes, resulting either in the thickening of the tissue, the formation of small cysts or polypi, or in the erosion or "ulceration of the cervix" which is so commonly referred to.

Metritis may exist as an acute or chronic condition. The former is rare, but when it does exist the whole of the uterine tissue becomes thickened and softened, frequently ending in the formation of pus. The chronic variety is more common, the walls being considerably thickened on account of the increase in the connective tissue as well as the muscle fibers in the tissue and also on account of the infiltration of small round cells. The inflammatory changes are usually along with some of the other inflammatory conditions in the different parts of the uterine tissue.

Perimetritis, or as it is often called a pelvic peritonitis, may result from many different causes, either arising from changes taking place in the uterus itself, or, as it does, not unfrequently, by the extension of a similar inflammatory process from some of the neighboring organs. The inflammation may be acute, spreading to the peritoneum generally, or it may be limited by adhesions so that abscesses which are formed may be entirely limited to the pelvic cavity being evacuated by rupture into rectum or vagina. If the inflammation is more chronic there is thickening and adhesion, so that the uterus becomes fixed being bound down by these adhensions.

Parametritis, or as this condition is frequently called pelvic cellulitis, arises in connection with operations or manipulations of uterus as in some forms of treatment to which it is subjected or even after ordinary cases of child birth. The result of the inflammation is that a considerable exudation takes place into the tissues around so that the uterus is sitting practically in the midst of a mass of exudation. If this exudation be mainly fibrinous then the changes which it undergoes leaves the uterus practically in a mass of connective tissue ; the tumor being large enough usually to be detected by examination per vaginam or per rectum. The fibroid enlargement may continue as a swelling, or as it sometimes does, it undergoes degeneration and forms an abscess which may simulate a lumbar abscess.

The infectious diseases to which the uterus is exposed are what are termed, puerperal fever and tuberculosis, both of them being of the nature of an inflammation with general symptoms superadded. The puerperal condition is really an infection due to the entrance of micro-organisms through the open wounds following the separation of the placenta, but may be set up through the infection of wounds of any kind in the region. The result of the infection is the establishment of an inflammatory process of an acute character, characterized by the tendency to slough, become gangrenous, and undergo suppuration. In some cases there is the formation of an exudation almost similar to the membrane in diphtheria. The general symptoms of the disease depend on the fact that there is the absorption of the products of bacterial activity, the formation of thrombi in the vessels and the diffusion of the pus through the blood stream to the different parts of the body in this way setting up the miliary or multiply abscess of pyemia. The tubercular inflammation of the mu-

cous membrane is nearly always secondary to a tuberculosis in some part of the body, commonly the tubes. The mucosa becomes the seat of many small nodules of caseated material, sometimes involving the deeper tissues, or it may be that the tuberculosis is of the miliary type. Syphilitic inflammation is of rare significance. when present it is in the form of small mucous ulcers or condylomata usually confined to the cervical region.

The degenerative changes are not very common but fatty degeneration accompanies the involution of the organ after pregnancy, and sometimes other conditions like phosphorus poisoning and some of the infectious diseases. Amyloid degeneration affects the vessels and occasionally the muscle fibers in the wall of the uterus.

The whole organ undergoes atrophic changes after the active period of pregnancy is completed and with very great rapidity, it does so also at the menopause when all the functionally active organs undergo retrogresive changes.

Hypertrophy of the uterus takes place in cases where there is an abnormal involution after the period of gestation. It may result also from the continued congestion of the organ or chronic inflammation and in some cases where there is no reasonable explanation for its presence. This refers to the condition met with apart from the changes incident to a pregnant uterus. There is a form of hypertrophy which affects the cervix and which is fairly common even apart from the general enlargement of the organ. The cervix has been noted so markedly enlarged as to present itself at the external orifice and this condition must be carefully kept in mind in cases where a prolapse of the uterus is suspected, having been mistaken for that condition when no such state of affairs existed. It is supposed to result from imperfect involution of the whole organ as already indicated in the case of the uterus itself, but may be produced by dragging of the vaginal walls in cases where the vagina is prolapsed.

The cavity of the uterus may be enlarged as the result of an obstruction to the flow from the interior. The obstruction may be a congenital malformation such as a closure of the os or an imperforate condition of the hymen; it may however arise from acquired causes such as stenosis following laceration at the period of parturition or surgical operations. The walls of the organ may become thickened as the result of the continued pressure within. or the pressure may result in thinning of the walls with a tendency towards rupture of the walls. The cavity may become distended with blood which should have passed away at the menstrual periods, such a condition being spoken of as hematometra; or it may be distended with sero-mucous secretion from the mucous membrane when it is spoken of as hydrometra; or the decomposition of the secretions result in the formation of gaseous material which is accumulated when it is spoken of as physometra.

There are several congenital conditions of the uterus which it is necessary to refer to, for example there may be such a condition as atresia of the organ, or there may be a hypertrophy entirely of a congenital origin which must be kept in view in the diagnosis of the different conditions where these systems are present. The uterus may be separated into parts by a septum, or it may be that the cornua of the organ are separated—the so-called uterus bicornis. There several forms of deviation in the form of organ, in some cases being double in whole or in part and even in some cases it has been known to be absent altogether.

The displacements of the uterus although frequent are scarcely necessary to be described in this connection seeing that they are more appropriately considered in the clinical departments of the Institution. The different positions the organ may be placed in depends upon the amount of the relaxing and stretching of the different ligaments and structures which keep it normally in position. The pathological changes taking place after the displacements are mainly those of a chronic inflammatory character, in other words the dragging set up irritation which probably ends in chronic inflammation and if the conditions are such that adhesions are possible then the adhesion of the organ takes place to any of the structures which are in proximity to it.

The tumors of the uterus are very important and they are of several different types. The chronic inflammatory changes referred to often terminate in the formation of small polypi on the mucous surface. Polypi may result also from the dilatation of the small-glands or vessels so that they form cysts, or retained portions of the placenta may become polypoid in character, as the result of the elongation of the polypus so that it has a pedicle, in fact any of the tumors might theoretically become polypoid in the same manner. The tumors which are spoken of as myomata are of great frequency and require to be noted particularly. They are of three different varieties depending upon whether they are in the wall—intramural—,underneath the mucous membrane—submucous—,or underneath the serous membrane—subserous. The tumors may be single or multiple of small or great size. The nature of the tissue of which they are composed has already been referred to in connection with the description of tumors in general, all that need be said here is to refer to their special forms and peculiarities. The interstitial or mural form involves the wall of the uterus and may increase to an immense size, so much so that the whole organ may be involved or remain small and mutiple. The organ and tumor has been removed without the true nature of the tumor being recognized. The sub-mucous perhaps is the most common to come to the notice of the practitioner and then it usually does so as the so-called fibroid polypus. In these cases it arises as a sub-mucous tumor but as it enlarges it keeps the mucous membrane in front of it until it becomes so pendulous that it appears at the external orifice of the uterus and sometimes at the vagina. The membrane cov_

ering the portion which becomes external being exposed to friction and the irritation of the external air becomes ulcerated, and so there is often in these cases hemorrhage and ulceration. The sub-serous occur as small nodules underneath the serous covering and as they increase in size they may become pendulous, or they may become entirely separated from their original location getting attached to some of the abdominal organs, or become entirely free in the abdominal cavity. In some cases the tumor passes in between the layers of the broad ligament. Any of these tumors may undergo degeneration or become infiltrated with some substance such as has been already referred to.

The other tumors of the uterus met with are mainly malignant, principally of the cancerous variety, affecting the cervical portion, chiefly, at the early stage. They occur as flat, ulcerating epitheliomata or as nodular excrescences. The former have irregular indurated edges with more or less infiltration of the tissues around; the latter form masses of greater or less size with infiltration of tissues adjacent and are very vascular. Either of the varieties are liable to end in destruction of considerable tissue. Another form is met with where the diseased condition is more of the nature of an infiltration, there being epithelial masses and nodules of diseased tissue in the normal tissue. The glandular portion of the mucosa becomes affected in such a way, as already indicated, that it is difficult to say whether it is a chronic inflammation with thickening or a case of glandular carcinoma. There is, however, a condition where a true glandular carcinoma exists. It may begin as an adenoma of simple character becoming malignant, or it may be that it was malignant from the beginning.

Sarcomatous disease may affect the uterus as a primary or secondary condition and then either as an infiltration or as a circumscribed nodule. They may involve the muscular wall or the mucous membrane and have a marked tendency towards destruction with hemorrhage in considerable proportions. A peculiar development after parturition has been found, and spoken of under various names, which seems to affect the decidua and associated with great tendency to hemorrhages and considered as of a sarcomatous nature. The mass consists of a number of irregular shaped cells with a very small quantity of intercellular structure but the true nature of the condition is still somewhat obscure. It has been called "deciduoma malignum" and sarcoma deciduo-cellulare."

THE OVARIES. The ovary in the female corresponds in its origin with the testicle in the male, so that they are, so far as origin is concerned, similar. The tissue of which the organ is composed is very vascular towards the center, but towards the periphery, the vascularity is less marked and the follicles (the so called Graafian follicles) in which the ova are developed, are found in that locality.

The inflammations of the ovary are mainly of a secondary nature either

travelling from some of the other parts of the generative tract or by extension from the peritoneum. The acute inflammation is nearly always associated with the puerperal state and may involve the whole of the organ or any of the different parts of it. The ovary becomes swollen, soft and congested with more or less serous exudation which may pass off or else terminate as an abscess, the pus being in small areas or else one large cavity. The condition may be confined to one of the ovaries or affect the two at the same time. The chronic inflammation of the organ may follow an acute attack or arise from other causes such as continued congestion of the organ from obstruction to the blood stream. The inflammatory changes are either thickening and hardening of the organ with contraction of the whole of the tissue, or the vessels may become dilated and the organ enlarged, the enlargement going on to the formation of cysts, so that the whole ovary becomes a mass of dilated vessels. The inflammatory changes are sometimes limited to certain points, in that case the ovary is nodular in appearance and the small nodules simulate tumors. The cystic condition of the ovary is sometimes due to the retention of the contents of the Graafian follicles as a consequence, probably, of the inflammatory changes affecting the outer part of the organ.

The specific inflammations of the ovary are tuberculosis and syphilis. The tubercular affection is mainly in association with some tubercular condition in some other part of the generative tract, and is mostly found as caseated nodules in the ovarian tissue. The syphilitic inflammation usually results in the formation of the gummatous tumors.

The ovaries are subject to congenital abnormalities such as absence of one or both of the organs, or it may be an additional one; sometimes even the organ is enormously increased in size. There may be quite an alteration in the position of the ovary from the normal, perhaps coming outside of the pelvis altogether as a hernia in the inguinal canal, the crural ring, or, as has happened, through the umbilicus.

The vascular affections of the ovary are congestion, of an active or passive nature, and hemorrhages which may be of a very slight character or be quite considerable, if slight, the blood is absorbed; but if more extensive, blood-cysts are formed. The corpus luteum or the yellowish body which is left after the rupture of the Graafian follicles is formed by the proliferation of cells in the wall of the follicle and the fatty degeneration which follows. The yellow spot also disappears after a time, and the place where it was is known by the fibrous spot which remains; eventually the whole of the ovarian tissue becomes scarred by these fibrous spots from which the ova have been discharged.

The tumors of the ovary are quite numerous, they are frequently of a cystic nature. We have already referred to the simple cyst, which may be formed by the accumulation of the contents of a Graafian follicle. They are

simple but may be multiple, in this respect differing from the other forms which are usually a mass of small cysts accumulated together in one large sac. The walls of the simple cysts are lined with epithelium and the contents are serous, but may be colored from the blood or the result of inflammation. The other cysts are (1) the colloid cystoma, in which the cyst is multilocular, and the contents of a gelatinous nature. These tumors are sometimes of immense size and involve the ovary as a whole, so much so that the outline of the ovary is lost, nothing being left but the tumor, which is made up of the cyst and its contents. The wall of the cyst corresponds to the outer portion of the ovary in these cases, but at other times may be made up of glandular tissue, so that on examination the wall consists of small acini lined with epithelium and resting on the basement membrane. Sometimes the inner surface of the cyst is covered by papillary outgrowths which have given the condition the name of papillary cystoma. These papillomatous tumors are nearly always bilateral, whereas the typical glandular variety are unilateral and have a greater tendency towards the formation of secondary cysts. (2) Dermoid cysts are sometimes met with. They consist of a sac lined by epithelium and full of a peculiar granular detritis, which consists of epithelium, cholesterine crystals, fatty debris and sometimes hair, teeth, or bone.

The solid tumors are not very common but may be fibromata or myo-fibromata or adenomata, with more or less fibrous tissue in the glandular structure. The malignant forms are sometimes present, they are usually in association with some of the simple varieties, but they may be found alone. Both carcinoma and sarcoma are found in connection with the ovary.

There is in connection with these cysts a question to be kept in mind, that sometimes cysts are found which are not in connection with the ovary. These are cysts of the broad ligament, parovarian cysts, hydatid cysts and sometimes cases where the ovum falls into the abdominal cavity and becomes cystic. The parovarian cyst is perhaps most important and is formed by effusion of fluid into the tubules of the parovarium, which are found on the broad ligament. The parovarium is a number of small tubules which remain as the representative of some of the Woolfian ducts. These cysts are unilocular and their contents are more fluid than the ovarian, the specific gravity of the former (parovarian) being under 1008 as a rule, the latter (ovarian) being over 1020. The peritoneal coat on the parovarian cyst is easily removed because it is formed by a distinct membrane, whereas in the ovarian the peritoneal coat consists of a single layer of endothelium and is consequently difficult to remove. The cyst of the broad ligament is recognized by its being between the layers of the ligament, and is formed by the effusion of fluid in that position. The hydatid cyst being due to the presence of the parasite.

The Fallopian Tubes are the seat of inflammatory changes of the different varieties. The term salpingitis is applied to the condition. The in-

flammation may be acute, of a catarrhal or suppurative type, and due as a rule to an infection through the uterus or the result of an extension from some other portion of the generative tract. In the catarrhal form the mucous membrane becomes swollen, and a considerable number of cells infiltrated into the tissues around, with more or less mucous secretion, which may later become mucopurulent. In the suppurative condition the walls of the tube are extensively inflamed and sometimes ulcerated, with a considerable quantity of pus accumulated in the interior forming a sac of varying size, which may retain the pus indefinitely or rupture and discharge into the abdominal cavity, the bladder. or the rectum; if retained it may become encapsuled and hard. The chronic inflammation is usually the result of an acute attack and and is characterized by the formation of new connective tissue in the walls of the tube, so that the tube is thickened and hardened. In addition to these changes, adhesions usually take place so that obstruction to the tube is likely to result.

The specific inflammations are tubercular and sypilitic. The former is either of a primary character or the result of infection from some area of disease. The lesion consists of thickening, with caseous masses in the different stages of degeneration, or a miliary type of tuberculosis in association with miliary tuberculosis in the body elsewhere. The tube may be dilated and filled with some watery fluid. The syphilitic inflammation produces the gummatous formation on the walls of the tube resulting in thickening and obstruction. These thickenings and obstructions produce a distended condition of the tube, and these areas of distension become filled with different kinds of material, to which different names have been applied depending on the nature of the contents. The tube being full of pus is spoken of as pyosalpinx; if it is full of a serous fluid it is spoken of as hydrosalpinx; if it be blood it is a hematosalpinx. The blood may arise from malpositions of the organs in the case of abortions or ordinary parturition, or it may be a hemorrhage where there has been some rupture of the vessels.

The tubes may be deficient as a congenital deformity. being entirely absent or somewhat abnormal, such as the complete closure of the end (stenosis) or the whole lumen of the tube. The tubes may become congested either as an acute condition in association with some inflammation around or any passive condition due to the obstruction to the blood stream.

The tumors of the tubes are either simple or malignant. The simple are fibroma, fibromyoma and lipoma; the malignant are sarcoma and carcinoma, the latter being nearly always secondary to a similar condition in the uterus or ovaries. Cysts of the tube are, as already referred to, the result of dilatation and obstruction, but in addition may be what is spoken of as the hydatids of Morgagni which are supposed to be vestigial remnants.

THE VAGINA AND THE VULVA constitute all of the portion of the generative

tract in the female which is external to the neck of the uterus, the former being spoken of as the "external passage."

The acute form of inflammation, to which the vagina is subject, is usually of a catarrhal type and is due for the most part to some form of infection or injury. The epithelial surface becomes congested and covered with a mucous secretion. The secretion sometimes becomes muco-purulent and at times the exudation may involve the deeper parts and then become exfoliated in the form of a membrane. There is a form of inflammation met with here which is of diphtheritic type, where large areas of the mucous surface is involved and thrown off. The chronic form of inflammation is present in cases where there is an impaired condition of vitality and is associated with a profuse discharge usually called leucorrhea. It is sometimes found that the surface has become eroded—that is, small ulcers of a superficial character are present—and the glandular structure may be thickened. Suppurative inflammation sometimes occurs as the result of injury or as the result of an acute inflammation. The pus may be discharged from the surface or it may accumulate in the tissue and form abscesses which destroy the tissues to a greater or less extent. We have referred to a form of inflammation in connection with the mouth which is characterized by the sloughing of certain portions of the tissue, and spoken of as noma, in the same way we have a similar form affecting the wall of the vagina in which there is extensive and rapid destruction of the part affected. The cause is not quite clearly understood, it has been thought to depend on a venereal origin but that is distinctly an error seeing that it may be present without any question of the presence of the other. It is probably the result of the acute inflammation and the changes which take place as a consequence.

The specific inflammations apart from the gonorrhoeal condition, which is similar to the condition already referred to as an acute inflammation, are the tubercular and the syphilitic, both of which are characterized by the formation of ulcers which may be quite extensive.

The vagina may be subjected to injuries either as the result of the force used in cases of difficult labor, or by the improper use of instruments. These wound are apt to open into the rectum when they are spoken of as recto-vaginal fistulae, or opening into the bladder are known as vesico-vaginal fistulae.

There are many congenital conditions to which the vagina is subject such as an imperforate hymen, an imperfectly formed canal, or the formation of septa in the course of its length; it may be entirely absent or it may be double.

The vagina may become prolapsed to a greater or less extent; if the bladder happens to be pulled down along with the vagina it is spoken of as a vaginal cystocele, if the rectum be drawn down then it is said to be a vaginal rectocele.

The tumors are in the form of polypoid growths extending from the va-

ginal walls and may be either fibromata or myofibromata. The condylomata which are met with in venereal disease are simply epithelial, being what has already been referred to as papillomata. The malignant forms are both present and may occur as diffuse areas of sarcomatous destruction, or canceerous projections. The cancers are usually secondary to a similar condition of the cervix or uterus. There are some cysts found in this locality some of which, at least, are the remains of some foetal structure; others are due to the distension of the glandular structures, while others may be the result of hemorrhages.

THE VULVA forms what is generally spoken of as the external genitals and is subject to many different conditions of disease.

The inflammations are the same as those which affect the vagina, being acute and due to infective causes, resulting in the swelling of the parts and the exudation which may end if the condition be severe enough, in suppuration. When suppuration takes place the pus may be diffuse or in the form of small abscesses. The inflammation may be of a croupous character or it may become gangrenous. The condition already spoken of as noma being frequently met with in cases of acute febrile diseases, or as the result of injuries. Chronic inflammations result in the formation of new tissue in the mucosa the formation of ulcerated patches and sometimes in the develepment of small papilla.

The specific inflammations are diphtheritic, in association with, or without, diphtheria and similar to the diphtheritic condition elsewhere; tubercular, in which there is much destruction of tissue, the condition being spoken of as lupus; syphilitic which is present in the form of the chancers characteristic of the primary lesion.

The tumors are variable. They may be found as small nodules or as polypi on the surface of the mucosa and be of several different varieties, simple or malignant. The simple are fibroma, myo-fibroma and sometimes lipoma. The small papillary tumors referred to as condylomata are often in this region as venereal affections. The condition spoken of as elephantiasis affects the vulva, in fact may begin in the vulva, and is due to some obstruction to the lymphatic system resulting in dilatation of the vessels, or it may possibly be that the dilatation is due to some cause which has not been yet differentiated but associated with some climatic condition seeing that it is frequently found in tropical climates. Cystic conditions are frequently met with and may be the result of dilatation and retention of the contents of the glandular, structures or they may be dermoid in character. The contents of these cysts are serous, purulent, bloody or granular detritis. The malignant forms may be present alone or in combination with some of the simple forms; the carcinoma being primary or the result of an extension.

In connection with the vulva and vagina it is well to note that sometimes

parasites may be found. The Trichomonas vaginalis being of importance on account of its resemblance to the spermatozoa. The vegetable parasites are the Leptothrix and the Oidium albicans, both being found in other locations, chiefly the mouth and throat.

THE MAMMARY GLANDS are usually referred to in this connection, seeing that they are associated with the function of generation, although they are not in relation so far as the anatomical configuration of the body is concerned. They are glands which are situated on the anterior wall of the thorax and are very active during all the stages of the child-bearing period, hence they are liable to the different diseases of the generative organs compatible with the structure of the glands.

The acute form of inflammation occurs at the period of greatest activity of the gland, that is, at the time of lactation when the product of conception requires to be nourished. It may be due to the abrasion of the nipple, obstruction to the flow through the terminal ducts, or the result of fissures in the skin allowing infection to take place, or it may be that it appears as a general condition in general puerperal lesions. The gland becomes enlarged and congested, hard and painful, with some infiltration of cells around causing induration of the tissues surrounding the gland. These changes may continue to increase and then the condition becomes one of suppuration or the formation of an abscess. These abscesses are recognized as presenting themselves in three different positions—either in the cellular tissue in front of the gland tissue proper, in the substance of the glands, or behind the gland, that is between the gland and the pectoral muscle. When abscesses form there is great tendency to the destruction of this gland on account of the spreading of the pus along the milk ducts and the consequent interference with the function of the gland when it is in the state of greatest activity. If the abscess rupture it may do so external, or it may pass backward and open into the pleural cavity. The abscess becomes encapsuled at times, the material remaining as a hard calcareous mass in the tissue. The chronic inflammatory changes result in the thickening of the connective tissue and the dilatation or tendency to dilatation of the milk ducts The inflammation may be so continuous and result in so many changes that the whole of the gland may become altered and its function seriously interfered with and perhaps destroyed altogether. The inflammatory changes may result in production of an eczematous condition of the nipple which has received the name of Paget's disease; it has a close relation to the cancerous disease of the parts affected.

The specific tubercular inflammation presents itself as a miliary formation or the development of caseous masses, sometimes in the formation of abscesses. Syphilis may set up the inflammatory changes associated with the condition and results in the formation of gummutous tumors. It may be that superficial lesions in the form of chancers or mucous patches may be present.

The mammae are subject to degenerative changes, undergoing a form of fatty degeneration or infiltration in which the gland seems to become almost entirely fatty. The appearance of the gland as a whole may indicate a considerable increase in bulk, but the increase is mainly due to the growth of the connective tissue, that is to say, the gland substance proper may have undergone atrophy. Atrophy of the gland is perfectly normal at the menopause, whether the menopause may have been produced artificially or established normally. Occasionally the gland becomes hypertropied even in young girls, or it may be in males. The enlargement may be due to a general increase in the organ or to some interference causing an enlargement of some of the parts of the organ.

The glands are liable to congenital abnormalities, such as, the formation of additional glands, which may be in almost any position. The gland may be abnormally active, being swollen and seemingly functionally active, in some cases shortly after birth.

Seeing there is so close a relationship between the mammae and the other generative organs, vascular changes, such as hyperemia at the menstrual periods are quite common and physiological in character.

Tumors of almost all of the varieties may be met with in connection with the mamma. Several of them being rare, such as lipoma, or fibroma, or even an enchondroma; while others are common like adenoma, adeno fibroma, adeno-sarcoma, cysto-sarcoma and the different varieties of cancer. The simple tumor, which is probably most frequent, is the adenoma which usually presents itself as a smooth encysted tumor. On section showing numerous glandular acini which may be somewhat dilated, the inner wall being lined by simple columnar epithelium, and the spaces filled with fluid. It is very common in association with sarcomatous conditions, when the tumor has a tendency to rapid growth and profuse hemorrhage. Carcinoma of the breast is common and may present itself as a glandular condition where the typical glandular formation is present, or it may be of the medullary type where a considerable portion of the gland becomes involved, which is soft and readily breaks down, forming an extensive ulcerated area; or it may be of the hard or schirrus type, which is probably most common, advances slowly and is characterized by the excess of fibrous tissue or stroma enclosing the true cancer cells. We have already mentioned the eczematous condition of the nipple spoken of as Paget's disease, which begins as a dermatitis and gradually involves the ducts, being of an epitheliomatous nature. The formation of cysts has already been mentioned in connection with dilatation of the ducts and in connection with the development of the simple adenoma and the adenoma-sarcoma. It is only necessary to add further, that the contents of these cysts are variable and undergo various degenerative changes.

THE MALE ORGANS OF GENERATION.

THE PENIS. We have already referred to the diseases of the urethra and refer now to the affections of the organ as a whole, apart from conditions of a urethral nature. The inflammatory condition known as balanitis is where there exists an inflammation of the glans as the result of irritation, uncleanness, or a gonorrhoeal infection. The mucous membrane becomes swollen and red, the exudation considerable with oedema of the prepuce. If the inflammation be sufficiently extensive it may result in ulceration or gangrene. When the inflammation is less acute and the prepuce becomes adherent to the glans then we have the condition known as phimosis; paraphimosis is where the prepuce has been retracted and the changes taking place either as the result of the inflammation or as the result of a contracted prepuce prevent the glans from being covered again by the prepuce,—sloughing of the glans often results from this condition.

The cavernous bodies are the seat of inflammation as the result of extension from some inflammatory condition adjacent, or as the result of traumatism or some acute febrile disease. The organ swells considerably and if the inflammatory change be very acute terminates in suppuration, if less severe it may result in the formation of fibrous tissue.

The specific inflammations are syphilis and tuberculosis. The syphilitic condition results in the formation of condylomata, or the true chancre and the ulcerated areas referred to as "soft chancres." The tubercular inflammation results sometimes from an infection at or after some surgical process where the germ of tuberculosis has come in contact with the wounded surface, or any other source where the germ can be communicated to the organ. The result is that ulcers are formed or the disease may become established in the system generally.

The congenital deficiencies of the organ are frequent. The penis may be entirely absent, but in those cases there is some general abnormality, or the organ may be found in different stages of development: for example the urethra may terminate in some part of perineum or in any part of the lower surface of penis, the penis itself being only partially developed, when we have what is termed a hypospadias: or the urethra may open on to the dorsal surface then we have an epispadias.

The tumors of the organ are of different varieties. The simple forms such as papilloma, either of a gonorrheal origin or some other irritation, or lipomata or fibromata, (the latter being either circumscribed or diffused) are not uncommon. The diffused fibroma is spoken of as elephantiasis and is found in association with the same condition in the scrotum. Cysts of the penis are met with at times and may be either of the nature of a dilated gland or a dermoid cyst. The malignant form is mainly of the nature of an epithelioma and is found at the prepuce or the glans and may be simply an ulcer or

as an excresence. The disease may spread so as to involve the whole organ and sometimes extends to the other structures through the lymphatic channels.

THE SCROTUM. The scrotum may be the seat of inflammatory affections which produce the same result as in any other tissue, that is to say, we may have an acute attack which results in the swelling an exudation, which if severe enough may suppurate, or if more chronic become thick and fibrous.

The tumors of the scrotum are both simple and malignant. The simple are lipomata, fibromata and the formation of cysts. The fibroma is found in association with, or produces elephantiasis. Elephantiasis is a condition where the tissue becomes thickened and hardened, and in connection with this there is a dilatation of the lymphatic vessels; it is supposed by some to depend upon the presence of the parasite filaria in the vessels, although its presence cannot always be demonstrated. The dermoid cyst may contain any of the products of an epidermal development. The tumor referred to as a teratoma is met with occasionally and the greater part of a skeleton of a foetus has been found in the interior of one of them. The malignant tumors are epitheliomata, as the result of irritation in the case of the chimney sweep, or in any case where continued irritation is possible and exist as small ulcers or involve the whole of the tissue of the scrotum.

THE TESTICLES. Inflammation in the testicle results from injury or infection, the infection being established either through the blood or through the urethra. The whole of the testicle may be affected or simply one of the different parts of which it is composed. The inflammation of the testicle itself is spoken of as an orchitis, and may be either of an acute, chronic or specific character. The acute form is characterized by swelling and effusion, with some round cell infiltration and if very acute may terminate as an abscess which may remain enclosed within the substance of the testicle, or reach the surface and rupture, in the former condition the abscess matter may become encapsuled or, as sometimes happens, be absorbed. The chronic form is characterized but the formation of fibrous tissue in the walls of the tubules or else between the tubules, in the one case the tubules may become converted into fibrous cords, or the intertubular tissue may become a mass of fibrous tissue, so that the tubules are obstructed or it may be obliterated; in fact the whole of the testicle may be changed into fibrous tissue. The specific inflammation induced by the bacillus of tuberculosis results in various different changes which seem to be difficult to explain, but probably the variation is due to a certain extent to the simple inflammatory changes mixed up with the specific and also to the fact that the structure of the testicle is very complex. The infection may take place through the genito-urinary tract as a primary condition or as a secondary condition in general tuberculosis. The disease presents itself in the form of small groups of cells in the walls of the tubules and vessels and in the interstitial tissue, or cheesy masses may be present

which break down and gradually make their way to the surface. In addition to these changes the epithelium lining the walls of the tubules separates off and undergoes different forms of degeneration obstructing the lumen of the tubes or becomes massed into bundles, in the tubules, in which are found the giant cell or a cell like the giant cell. The walls of the blood vessels are often the seat of a condition similar to that already described as obliterating endarteritis. The syphilitic inflammation is characterized by the formation of fibrous tissue much in the same way that it is found in chronic inflammation, in fact it is said that chronic inflammation is often produced by syphilis, or the formation of the typical gummatous tumor.

Inflammation of the epididymis is frequent when the testicle is not involved but it may be in association with an orchitis. It is the result of an extension or an infection, but of course may be produced also by injuries. The inflammatory changes begin in the tubules as a catarrhal condition associated with infiltration of cells and resulting in the formation of abscesses, or if less acute in the formation of fibrous tissue, the latter usually produces an atrophic change in the testicle.

The tunica vaginalis is the seat of inflammatory changes and is spoken of as vaginitis testis or periorchitis; the changes which take place in the different stages of the inflammation are similar to those described as taking place in the peritoneum seeing that the tunica vaginalis is a continuation of the peritoneum. The inflammation may be the result of injury or extension. The accumulation of fluid is quite common in this condition and is the result of an excess of serous exudation. If the condition is chronic we have an accumulation of fluid similar to the accumulation we find in the pleural cavity spoken of in this position as a hydrocele of the tunica vaginalis. When the effusion is continued the tunica vaginalis becomes thickened as the result of the prolonged inflammatory changes taking place. In connection with hydrocele of the tunica vaginalis, it is proper to notice that similar effusions of fluid take place into the different parts of the peritoneal sac as it encircles the different parts of the cord and testicle, and terms are applied to the condition depending only on the position of the fluid and not the nature of the fluid. The inflammatory changes are sometimes sufficiently acute to result in suppuration then we have a collection of pus in the tunica vaginalis, but pus may also be present as the result of a rupture or passing of an accumulation of pus from the testis or epididymis into the sac or cavity. Occasionally hemorrhage takes place into the sac as the result of an injury or the inflammatory changes.

The specific inflammatory changes may take place in the epididymis and the tunica vaginalis in a manner somewhat similar to that described as taking place in the testicle.

The seminal vesicles may be the seat of inflammatory changes which result in the case of the acute condition in the accumulation of the exudation in

the vesicles, the formation of an abscess, if the inflammation be sufficiently acute, or if more chronic the formation of fibrous tissue with the changes which that extra development leads to. The tubercular form may be present here also, as an associate with a similar condition in some of the other parts of the tract.

The tumors of the testicle are simple and malignant and of considerable frequency. The simple are fibroma, lipoma, adenoma, chondroma and occasionally osteoma. In addition to these which are rare we have cysts and teratoma, the former particularly being not uncommon. The cystic tumor is the result of a dilatation of the tubules at times, or they may be dermoid in character. The malignant are of both varieties, the sarcomata being most frequent in the testicle as distinguished from the different parts and may exist in any of its forms, the carcinomata may be either of the soft or hard type and involve the whole of the testicle or part of it or even extend to and involve the tissues of some other part in addition.

The testicles are frequently affected by congenital abnormalities being sometimes absent altogether, sometimes extra developed, or in some cases, and perhaps more frequently than the others, concealed in the abdominal cav-ity having never descended from the position they occupy in the early stage of existence.

The degenerative changes to which the testicles are subject are fatty and myxomatous, the latter most commonly in connection with some of the tumors. Calcification is met with in association with the products of inflammation and the changes to which they are subject. The testicle undergoes atrophic changes in cases where there is any obstruction to the supply of nutrition, as in varicocele or pressure from tumors, and is normal in the adolescent period. They may undergo hypertrophic changes, in some cases as a physiological condition where one has become inactive, or the two testicles may enlarge without any apparent cause for doing so.

The circulatory disturbances of the testicle should be considered and we find that as the result of continuous congestion we have the dilatation of the veins and the varicocele already referred to produced, further than this, exudation, or perhaps we might say dropsy takes place and we have a hydrocele as the result. The circulation becomes increased in inflammatory conditions and in acute febrile diseases and we may have inflammatory changes taking place in the vessels themselves.

THE PROSTATE GLAND. The inflammatory conditions in the postate gland are common, they are either acute or chronic, the result of infection or irritation and may terminate at times as an abscesss. Tubercular inflammation results in considerable increase of the gland and the formation of caseous nodules, being usually along with tuberculosis in some other part of the body.

The gland is frequently hypertropied in the adult condition, either in

whole or in part, the cause for this increase being obscure. Atrophy takes place in connection with removal or atrophy of the testicles or inflammation. The gland may undergo fatty degeneration.

The simple tumors are adenoma and the formation of cysts. The malignant are sarcoma and carcinoma, the latter being more common and affect the whole gland or simply the tubules of the gland.

DISEASES OF THE NERVOUS SYSTEM.

THE PERIPHERAL NERVES. In considering the diseases of the nerves it is necessary to keep in mind the fact that nerves consist essentially of the axis-cylinder, with the sheaths superadded and that they may exist as an individual fiber or in bundles with connective tissue interlaced and interwoven around and among them.

The acute form of inflammation is found in connection with nerves which have been subjected to injury, or the result of an extension from some other structure adjacent. The inflammatory processes may affect the nerve fiber, or the sheath without the fiber, and is characterized by swelling, increased redness with some effusion and perhaps, if aucte enough, the formation of pus. The lesion may be uniform over the length of the nerve, or it may involve certain areas only, appearing as fusiform swellings in the course of the nerve so that the sheath or axis-cylinder may be broken up. Chronic inflammation of the nerve is characterized by the formation of fibrous tissue so that the nerve fiber and the axis-cylinder may become pressed upon and their function impaired or, it may be, lost altogether. There is a form of inflammation spoken of as multiple neuritis or polyneuritis, which differs only from what has already been described, in this, that the nerves may be affected at different points at the same time, from the same cause probably.

The specific inflammatory affections of nerves may be spoken of as (1) tubercular, in which there is osseous masses, or cells of the tubercular type; (2) syphilitic, in which gummatous tumors are formed, or the fibrous tissue thickened; or (3) leprous, where the peculiar tissue already referred to in connection with leprosy is formed among the fibers and which results in the formation of the anaesthetic condition found in association with the disease.

Degeneration in nerve structures is well seen in cases where the fiber has been severed and is supposed to depend on the separation of the fiber from the connection which it normally has with its ganglion or "center" The medullary sheath is first affected, the change consisting in the disintegration or breaking up of the normal structure into drops which become somewhat fatty and perhaps ultimately absorbed, or remain in that condition and position indefinitely. The nuclei which are found to exist in the internodal portion of Ranvier are supposed to take some active part in these changes, and as Ranvier himself has pointed out , are supposed to increase in size, divide, causing the sheath and the axis-cylinder to become broken up by the

pressure exerted upon them by these nuclei. The end of the nerve so cut becomes enclosed in a mass of cells (the normal process in repair in every tissue) which constitutes a fibrous mass eventually, but prevents the function of the nerve being carried on until by a process of gemmation the axis-cylinder on the one side becomes approximated to the axis-cylinder on the other; this has been referred to as regeneration in nerves.

The nerve fiber may undergo atrophic changes depending upon the pressure exerted by the products of an inflammation, or as the result of changes taking place in the central nervous system.

The tumors which are in connection with nerve structures are either of the simple or malignant type. The term neuroma has already been referred to when speaking of tumors in general and refers to a condition where the tumor is formed of more or less true nerve tissue of a new formed character; the false neuroma is a condition where the tumor is formed of tissue different from nerve tissue and consisting of fibrous tissue or muscular tissue, both of which may be found in the nerve fibers to give origination to the formation of the particular form of tissue characteristic of either of them. The malignant formations may be either a sarcoma or a carcinoma or they may be present in combination with some form of benign tissue and constitute a mixed tumor.

THE SPINAL CORD AND ITS COVERINGS.

The spinal cord is that portion of the nervous system which lies within the canal formed especially for that purpose in the vertebral column and is in direct connection with the cranial portion to which we will refer later.

Inflammation of the cord is spoken of as myelitis and is found in different forms, the term is used rather vaguely at times as if it covered all forms of changes to which the term softening could be applied in connection with the cord. It is common to refer to the different forms of myelitis according to its distribution, for instance diffuse, transverse or disseminated.

The acute form of myelitis is found usually to limit itself to a particular portion of the cord, so the term transverse myelitis is sometimes applied to indicate the condition, and further, as softening is the characteristic of the lesion it is sometimes referred to as acute softening of the cord. The appearance presented of a portion in this condition may be described as the destruction of some parts of the nerve tissue and fatty degeneration of other parts, in this way we can explain the variety in appearance that the tissue presents: it may be white, grey, red or yellow, owing to the degeneration and amount of hematogenous material thrown out and the changes to which it is subject during the process. The greatest degree of softening is usually found in the grey portion although the whole substance is somewhat involved. The term poliomyelitis is applied to the condition when the lesion is confined to the grey matter and is well seen in cases of infantile paralysis. In the case of

the poliomyelitis anterior acuta, the symptoms develops suddenly and seeing that at least some recover it is certain that the nerve structures cannot be entirely destroyed. In the earliest case where the cord has been examined it was found that the changes were increase in redness, dilatation of vessels in the region affected and sometimes hemorrhagic spots in the tissue with some infiltration of cells around, but in the later cases the changes were more characteristic of degeneration due to continued pressure or inflammation.

The chronic form of myelitis, comparable to the variety above mentioned except in its chronic stage, results frequently from the acute or as the result of continued pressure. The changes are the formation of fibrous tissue which if considerable in extent sometimes gives rise to the term interstitial inflammation or interstitial myelitis. The result of this new formed tissue is, that atrophy takes place from pressure, and the new tissue becomes hard and the term sclerosis is applied to the condition, which may be of sufficient distribution as to produce serious results so far as the function of the cord or the part of the cord involved is concerned. The distribution of the areas of sclerosis is important in its bearing to the forms of disease, so that it is common to take notice of the fact that particular lesions produce particular symptoms, for example sclerosis of the posterior columns is the lesion in cases of locomotor ataxia; multiple sclerosis where diffused areas of circumscribed hardening are distributed extensively in the tissue with variable lesions, such as muscular tremors, nystagmus, etc.; lateral sclerosis when the lesion is confined to the lateral portion, associated with spastic paralysis; and the condition already referred to as the chronic form of poliomyelitis where the anterior cornua has become atrophied and the ganglionic cells sometimes entirely lost.

Degenerative changes take place in the cord, and in connection with degeneration and its changes it may be said that anything which causes a sepation between the fiber and the cell will necessarily be followed by degenerative changes, seeing that the fiber has been cut off from its "center" upon which it depends for its nutrition. It is common to speak of primary and secondary degeneration; the former where the degeneration takes place without any apparent cause, as in the condition referred to as locomotor ataxia; the latter, where definite lesions or causes exist to explain the presence of the degeneration, as in injuries to or wounds of the cord or parts of the cord. Secondary degeneration is also spoken of as ascending or descending, the former where the sensory fibers are involved (the degeneration traveling in the line of the functional activity of the fiber,) the latter traveling downward, that is in the direction away from the center and in this case involving the motor fibers.

The vascular changes taking place in the cord are of different forms and may be classified according to their results. We have a hyperaemia which is either active or passage, (the former being more of a clinical feature than a

pathological, but sometimes existing as such,) the substance being engorged with blood; the latter being the result of a continued stagnation of the blood stream and involving the vessels of the cord as well as the vessels of the meninges. Anaemia of the cord presents itself as a pathological condition in cases of faulty nutrition, the affected portion being swollen, soft and colorless, the cells undergoing or having undergone degeneration. Hemorrhage into the substance of the cord may be found as small spots of blood from the capillaries, or in considerable quantity; the former being spoken of as punctate or capillary apoplexy, the latter as apoplexy of the cord. The former is frequently found in acute febrile diseases the latter in cases of injury or inflammatory conditions involving the cord. The blood may leave small specs of coloration in the tissue or, if extensive, cysts are sometimes formed. Another condition where an abnormal condition of the blood supply exists is that which has been spoken of as a hematomyelia in which the central canal of the cord is dilated and filled with blood. The blood may be the result of some traumatism or degenerative change in the cord or in some cases of syringomyelia, but it must be kept in mind also that the blood may have been thrown into the canal at the instant of death in what has been spoken of as the agonal period.

In connection with the different forms of diseased conditions which are present in the cord it is necessary to refer to that condition (hydromyelia) in which the canal of the cord is dilated and filled with the cerebro-spinal fluid. There is an other condition where abnormal openings exist in the cord in any position without having any relation to the central canal and without the normal epithelial lining which is present in the canal; the term syringomyelia is applied to the condition. This condition has been mistaken for a hydromyelia and also for a hematomyelopore which is the cavity left after the absorption of the blood in cases where the blood had been thrown out in columns between the fibers of the cord.

There are several forms of congenital deficiencies in association with the cord, for instance cases are on record where it was absent altogether, sometimes double or only partly developed, but these conditions are quite incompatible with an individual existence, that is to say the foetus could exist in connection with the maternal existence but could not have an independent existence. The relation of the different parts of the cord may be altered sometimes the result of injury, (in fact some writers say that it is always due to injury,) or the relation of the nerves as they leave the cord may be altered. We find another condition in association with spina bifida, in which the meninges of the cord may protrude alone through the division, or in connection with them more or less of the substance of the cord; in some cases the whole of the cord posterior to the canal of the cord may be included and the term myelomeningocele is applied to that condition.

Tumors are either simple or malignant, although the simple are not very

common if we consider the gliomatous form as being malignant as many do. The glioma is perhaps the most common of any form met with and it may be found as an elongated swelling involving the nerve roots or as a localized small tumor; in either case giving rise to changes in the cord as the consequence of the pressure. Sarcomata are not uncommon either alone or in association with some other form and the condition referred to as syringomyelia is commonly met with beside it. Secondary cancers and sarcomas are met with also. A dilated condition of the blood vessels may give rise to an angiomatons tumor.

Cysts are sometimes met and may result from the conditions already referred to or as a parasitic cyst.

THE MENINGES. We have to consider the three membranes the dura mater, the pia mater and the arachnoid.

THE DURA MATER. The membane is liable to be involved in inflammatory conditions associated with inflammations of the bony structures adjacent, or as an extension from the membranes of the brain. Acute inflammation, or pachymeningitis as it is called, results in the engorgement of the vessels to such an extent that they may rupture, then the term hemorrhagic pachymeningitis is applied, and the exudation of fibrinous material which may become vascularized and result in adhesions, or if acute enough, may suppurate. The chrouic form has considerable new tissue formed and in connection with it there is the deposition of the sandy material which gives origin to the term psammoma, if the swelling is localized enough to form a tumor or small nodule. The most common form of inflammation is the tubercular and it may be diffused over a considerable area of the membrane or localized to certain parts and is usually the result of an extension of the condition from the membranes of the brain or from the vertebral column; if the latter, then it is most extensive in its effect on the external surface of the membrane, at least in its earlier changes. The condition is characterized by the caseous masses with areas of thickening around, the thickening being well marked in cases where it is along with a caries of the vertebrae. The syphilitic changes may be of the nature of gumma or thickening.

The tumors are both primary and secondary, the former, both simple and malignant, the latter, malignant of either form. The simple are fibrous, fatty, cartilaginous, bony; the malignant either alone or with some of the others in conbination. The cystic formations are usually parasitic.

THE PIA MATER AND THE ARACHNOID. The acute form of inflammation is spoken of as a leptomeningitis, it is usually an extension from the membanes of the brain. It results in effusion between the dura and the arachnoid with a tendency to involve the cord, the effusion being either serous, or if very acute, purulent, and if less acute, of more fibrinous nature, tending towards the formation of new tissue and ultimate adhesion. The

chronic type is evidently a continuation of the state just mentioned where the new tissue becomes hard and extends into the substance of the cord itself at times. Tubercular inflammation is mostly an extension and may be either miliary or in cheesy nodules. Syphilis is characterized by the development of the gummata or in thickening. The tumors are similar to those referred to in the dura mater.

DISEASES OF THE BRAIN AND ITS COVERINGS.

The brain consists of the cerebrum, cerebellum and the basil ganglia. In considering the diseases of the brain it is necessary to consider the anatomical configuration of the different parts of which it is composed, the sulci or convolutions which cover the whole surface of the brain, and also the fact that these sulci when better developed are spoken of as fissures and that they (the fissures) bear a very important relation to the different parts of the brain tissue. The blood supply is of some importance also in view of the common forms of vascular disturbance which result in serious disturbances of the function of the brain. The circle of Willis at the base gives the three vessels which must be well understood, the anterior, middle and posterior cerebral. The anterior is distributed to the frontal portion and its branches lie mainly in the sulci; the middle (of great importance seeing that it is most frequently the seat of hemorrhage) lies in the Sylvian fissure and supplies the middle portion of the brain, at the same time part of the inferior frontal, the parietal, and part of the temporo-sphenoidal; the posterior supplies the posterior part of the brain and is chiefly distributed on the surface. It is common to distinguish between the larger arteries (those just mentioned) and the smaller or the nutritive, or branches of these larger ones, and in connection with these nutritive vessels it should be noted that they are not very abundant as compared with the nutritive vessels in some other areas of the body. It may be that this scarcety in the supply of nutrition has some significance in connection with the frequency of conditions of impaired vitality in the brain tissue.

The acute form of inflammation which is found in brain tissue is spoken of as encephalitis and may be the result of some form of infection, or in connection with some infectious disease such as tetanus or diphtheria, and is then usually of a diffused type, or it may be localized in small areas in such cases as influenza or following injuries. The lesion is characterized by softening and some change in color; the softening being due to the infiltration of round cells, and the color depending on the amount of blood in the tissue, or the fatty degeneration of the area involved. When the area involved is highly colored with the blood or the pigment from the blood, then it is referred to as red inflammation, if it is pale as the result of fatty degeneration, it is referred to as yellow inflammation. The nerve cells undergo degeneration and this spreads to the nerve fibers, the axis-cylinders being destroyed and the

whole tissue more or less granular. The inflammatory changes may be acute enough to terminate in abscess or the abscess may result from the circulation of the septic products and the production of the septic foci. These abscesses may be small with a capsule or larger without a capsule. In the case of the abscess without a capsule, the cavity contains broken down tissue along with the purulent material, the abscess with the capsule is enclosed by a connective tissue membrane and the contents are soft or cheesy, in the latter case the fluid being absorbed. Chronic inflammation, or interstitial encephalitis results in the formation of cicatricial tissue which may be sufficiently hardened to become sclerosis; the sclerosis being in very small patches or diffused over large areas of the brain tissue, and exist as a single patch or as many patches, when it is spoken of as multiple sclerosis. In consequence, probably, of the sclerosis the nerve tissue degenerates and becomes somewhat granular. The chief lesion being in the interstitial tissue which becomes increased and hardened.

The specific forms are the sypilitic and tubercular. The syphilitic is characterized by the formation of the gummatous tumors, which are usually near the surface, or by the formation of a diffuse granular condition which is somewhat soft and greyish in color. The tubercular inflammation mainly results in the development of localized tubercles with a variety of different shaped cells around, and cheesy in the center or the whole of the tissue may be made up of small tubercles; in either case the bacillus tuberculosis may be present.

The vascular disturbances in the brain tissue may be classified according to the condition of involvement of the vessels or of the circulation only. The vessels are subject to the degenerative changes already referred to in general such as atheroma, aneurisms, thickenings of the walls and degeneration of a calcareous nature; in any of these cases the blood supply is embarassed, in some of them there is a marked tendency to rupture. When an obstruction to the entrance or flow of the blood exists then there is an inadequate supply and the tissue becomes anaemic, almost colorless and somewhat harder. If the anaemia be long continued the whole of the tissue shrinks and the sulci are wider than normal. The opposite condition is not uncommon where an excess of blood is present, this state of affairs being seen in the case of acute febrile disturbances, and in inflammations adjacent; or it may be found in cases of continued obstruction to the circulation such as exists in cardiac lesions, being then spoken of as passive hyperaemia. In all of these cases the tissue is darker in color owing to the increased amount of blood present, the latter also on account of the staining of the tissue from the coloring matter, the vessels are dilated and the nerve structures are somewhat softened and destroyed. In the case of the passive form, the ventricles are probably distended with an excess of cerebro-spinal fiuid and the tissue edematous. Edema may exist

without this general hyperaemia as a local condition in cases of local soften-ing.

Hemorrhage from the vessels into the substance is quite common and may be either in the form of small spots or as an extensive condition, the former from the smaller vessels, the latter from the larger ones. In the case of the punctate variety, it is commonly found where hyperaemia has existed for a period of time or in convulsive conditions or in connection with some inflammatory condition, it may simply be an extravasation without rupture. The extensive hemorrhages usually come from the middle cerebral although any of the vessels are more or less liable to rupture particularly those of the pons, and scarcely ever exist unless the walls have been previously diseased or as the result of an injury. The blood is found in masses which are quite irregular in size and shape, and may be distributed somewhat depending on the density of the tissue—being more diffuse in the white than the grey for that reason. In some cases the blood makes its way into the ventricles fill-ing them up. The part of the tissue involved in the hemorrhage becomes softened, the nerve cells and fibers broken up and if recovery takes place the mass may become encysted and remain as the apoplectic cyst; or the fluid portion absorbed leaving a dry mass within the cyst; or it may be organized and the tissue remain as a hard, pigmented scar. The walls of the cyst are supposed by some to be formed by connective tissue, by others, of the neu-roglia which lies between the nerve structure. As the result of these hemor-rhages into the tissue and the changes that take place, the condition spoken of as secondary degeneration follows in which the fibers become destroyed according to the plan already mentioned in the line of their functional activ-ity, so that we have symptoms depending on the zones affected and in post-mortem examinations the different areas corresponding to these zones are found degenerating or already degenerated.

Very closely associated with the actual hemorrhages we find thrombosis and embolism, the former may be found in cases where any condition exists which would cause the wall of the vessels to become roughened or even in cases where no apparent change has taken place in the vessels, the latter in cases of cardiac lesions where the small vegetations on the margins of the valves are set free and carried in the blood stream to the brain, in that case most frequently by the middle cerebral artery as it is in direct line with the heart. In connection with this it is well to remember that the vessels in the brain are many of them end-vessels and as a consequence are readily the seat of a hemorrhagic infarction. The result of this obstruction to the supply of blood, if the vessels are in general distribution, is that the circulation in a very short time becomes re-established through the collateral vessels, but should it happen that the vessels are end-arteries then the tissue undergoes degen-erative changes, of course that is not making allowance for the condition of

hemorrhage which may take place on account of the obstruction, if that take place the changes are as already described under hemorrhage. The brain tissue softens and becomes broken up, in other words the effect of the obstruction in these cases is the degeneration of the tissue which is nearly of the nature of softening. The different terms applied to the different forms of softening are simply terms suggested by the color, for example, red softening, in which there is a considerable proportion of blood, or coloring matter from the blood, present; yellow softening, is where the coloring matter has been to a great extent absorbed; white, when the softening is associated with the formation of fat, or as some think, where the softening may arise from some serous exudation in the form of an infarction.

If the softening takes place it is characterized by the quantities of broken down brain tissue, nerve fibers, nerve cells, blood cells and somewhat of a fatty degenerative condition in which the cells are made up of drops of oil along with some cholesterine crystals, crystals of fat and other granular detritis. These materials may be incased within a capsule or they may become absorbed or remain in the form of cicatrices as already referred to in the relation to the hemorrhages.

The degenerative changes in the brain tissue in addition to these mentioned may be spoken of as atrophy, which may be normally present in old age or as the result of changes which interfere with the proper nutrition; hypertrophy, which sometimes presents itself in the child, very rarely in the adult, and characterized by the increase in size of the brain, probably as the result of a hyperplasia of the whole tissue although some seem to think It is only the neuroglia which is affected; pigmentation, calcification and granular degeneration have been noted also.

It has been stated by De Quervain that the essentials of a diagnosis of disease of the brain depended on the presence of the following factors: (1) modification of the nucleus of the cell; (2) vacuolization of the nucleus; (3) disappearance of the nucleus; (4) diminished staining capacity; (5) swelling of the ganglion cells: (6) fragmentation of the protoplasmic processes; (7) shrinking of the cell; (8) vacuolization of the protoplasm; many writers consider that these are not enough to depend upon in some cases.

The congenital defects in the brain as a whole are many but they practically fall out side of the scope of this present work.

Without further reference to the affections of the special parts of the brain we must consider the question of the variations in the cerebro-spinal fluid. In this connection we notice that the special dilatations of the original canal of the cord, and spoken of in this connection as the ventricles of the brain require to be considered not so much as to their anatomical relations and description as the fact that they exist and under normal conditions are supplied with a certain quantity of fluid but that under certain conditions this fluid be-

comes excessive and it is then spoken of as hydrocephalus. The hydrocephalic condition may be congenital and involve the whole of the ventricles or as it usually does only some of them, it is then referred to as a partial hydrocephalus as compared with the condition where all are involved and therefore complete. Apart from the congenital origin of the condition it may be acquired as an acute variety in association with meningitis, or chronic as the result of a long continued inflammation or as the result of an obstruction to the flow of blood through the veins of Galen being then simply a dropsical condition. The result of these accumulations of fluid within the brain tissue is simply a pressure upon the different parts and consequently a flattening of the convolutions and of course an impaired circulation with symtoms of edema and anaemia.

The tumors associated with the brain are variable and frequent, simple and malignant. The most common form is that which has been referred to as a glioma, they may be present in any portion of the brain, are usually small and are composed of neuroglia with a varying number of cells; some consider the tumor to be a quasi-malignant one, particularly as it is often associated with a sarcoma. The sarcoma is considered next in frequency to the glioma and may be found in any of its forms but probably mostly as a round celled type. Carcinoma are not very common, but may be present, they are usually secondary and consequently conform to the type of the original. The simple forms are fibroma, lipoma, osteoma and angioma. Another tumor is referred to as quasi-malignant, the psammoma, or brain sand tumor so called because of the calcareous particles found in the tissue, it has been mentioned in connection with the tumors of the cord.

THE MENINGES. The same number of coverings exist in association with the brain that has been mentioned in the description of the cord.

The acute form of inflammation of the dura mater is spoken of as acute pachymeningitis and may be principally localized to the outer surface when it is said to be an external inflammation of the dura, or it may be chiefly located in the inner surface then it is an internal inflammation. In either of these cases it may be secondary to an inflammation of or injury to the cranial bones and may result simply in softening and swelling with the formation of granulation tissue and adhesion or the inflammation may be acute enough or become septic and terminate in suppuration. The chronic form is practically similar to that type just mentioned where the granulation tissue and adhesions result, which may be localized to a certain part or be diffuse and the exudation may become ossified, it is then spoken of as ossifying pachymeningitis. The condition referred to of suppuration may be called a suppurating pachy meningitis and may be the result of the causes mentioned or as the extension of an abscess of the middle ear. In some of these inflammatory conditions referred to serum accumulates between the layers of the new formed tissue and in this way there may be accumulations of fluid.

The tubercular inflammations exist as tubercles in the membrane or on its surface and is secondary or else alone with general tuberculosis. The syphilitic condition is characterized by the formation of single or multiple gummata on the surfaces of the membrane, sometimes they break down and form abscesses.

The vascular changes connected with the dura mater are either of the nature of an interference with the circulation or as hemorrhage, the latter being not uncommon either under or above the membrane, the result usually of some external violence.

The tumors are sarcoma, carcinoma, osteoma, fibroma, lipoma, and sometimes a muscle variety. Parasitic cysts are found. and the parasite of the trichina spiralis is met with.

THE PIA MATER AND ARACHNOID. The inflammation of these membranes is spoken of as a leptomeningitis and may be either acute or chronic. The acute form is quite common in some acute diseases such as pneumonia, in fact is often found with the bacillus of pneumonia without any pneumonia being present and it is the characteristic lesion in cerebro-spinal meningitis. It exists sometimes as an increase of the cells of the membrane without any exudation at all, but it also exists as an exudative (the former is spoken of as cellular) inflammation in which there is the exudation either of the fibrin or sero-fibrin in varying proportions, the serum remaining in the tissue or the fibrin coagulating and filling up, and covering sometimes, the whole of the convolutions. The exudation may be purulent in that case the whole of the surface of the brain is bathed in pus, or the part affected if the condition be localized. The chronic form of the inflammation results in thickening of the part affected, the consequence being that the nerve tissue becomes atrophied on account of the pressure or the parts may become adherent. In any of these forms of inflammation hemorrhage is liable to take place in the form of minute specs.

The tubercular inflammation is usually secondary and is of considerable frequency. When it is circulated through the blood the lesion is of the general miliary type and the tubercles located at the base when it is referred to as a basal meningitis, or they may be on the upper surface or they may be localized to one point, in that case the lesion would consist in a localized tubercle or caseous mass, but in the others it would be of the disseminated type. The tubercles are found between the pia mater and the arachnoid and are variable in size; the membranes (the pia mater and the arachnoid) are congested, with some exudation which may be serous then they are usually edematous and the surface of the brain is flattened from pressure. In some of these cases the exudation is considerable, the spaces being filled up with fluid or the accumulation may be so great as to involve the ventricles also, and produce the acute form of hydrocephalus already referred to.

Syphilis has the usual tumors formed, they may be variable in size and

color and undergo degenerative changes or be associated with the thickening of the tissue adjacent.

The tumors are fibroma, lipoma, osteoma, sometimes chondroma and the formation of cysts. There is sometimes an accumulation of blood which may be called a hematoma The Pacchionian bodies are small masses of fibrous tissue with some calcareous particles in the tissue, they are situated along the superior longitudinal sinus. The malignant forms are sarcomata and that peculiar form referred to as endotheliomata.

DISEASES OF THE BONES AND JOINTS.

In the study of the diseases of the bones it is necessary to know the structure and development of these bones in order to understand the relationship existing between the condition of health and disease, which is in this case quite close. The shafts of the long bones grow from one primary osseous center to start with, although several may appear later, the ends or the epiphyses also having a center of ossification so that the length of the bone consists in the growth from these centers until the whole of the bone already laid down in cartilage is transformed into true bone, later however the growth takes place in the plate of cartilage which is interposed between these epiphyses and shafts. Any abnormal condition of this cartilaginous plate will result in an abnormal development of the bone; it is quite easy to see how shortening may take place in a limb simply on account of the early ossification of this plate of cartilage. The bone also grows to a slight extent in the haversian canals and from the osteogenetic layer of the periosteum. The periosteum is concerned in the nutrition of the bone seeing that from it the vessels pass into the surface of the bone in an oblique direction; the nutrition of the bone is also supplied through the nutrient artery, and at the same the articular ends of the bones are supplied directly by the articular branches, all these points require to be kept in view.

The inflammations in bone are somewhat frequent and on account of the peculiarity of bone are variable. The acute form of inflammation is nearly always of an infecive type and is associated with an inflammation of the marrow as well as the periosteum; it is spoken of as osteo-myelitis when the marrow is affected, osteitis if the bone alone. The acute inflammatory condition results in the congestion of the part, with swelling, which in the hard dense and unyielding bone usually causes death of part of the tissue and so necrosis takes place. The inflammation is followed by changes in bone which have given rise to certain terms indicative of the condition, such as rarefying osteitis and condensing osteitis, the former by the absorption of the bone around the haversian canals, the latter by the formation of new bone in the same position as the absorption is taking place in the rarefying variety. Suppurative osteitis is simply an abscess in the bone and is the result of acute inflammatory changes associated with the pyogenic micro-organism. It is

usually found at the ends of the long bones in the cancellous portion. The abscess may remain in the interior of the bone for a very long time without being apparent at the surface, but along with constitutional symptoms of course. In some cases the pus is not contained within a cavity, simply infiltrating the bony tissue.

The tubercular form of osteitis is practically a rarefying form with the formation of caseous nodules or the condition may be one of miliary tuberculosis. The bone around may be somewhat thickened and the tubercular lesion is frequently spontaneously healed by the formation of new bone around. As we have already indicated it is claimed that the disease begins as an embolic condition, the bacilli being the emboli and the focus being established the disease spreads from it. It may be that the formation of abscesses takes place in connection with the tubercular lesion and thus we have the tubercular abscess to deal with.

The syphilitic inflammation is characterized by the formation of the gummatous tumors or else some of these different forms of inflammation, already described. The congenitial type differs somewhat from the adult, the line of the epiphyses and diaphysis being affected in these cases. The process of ossification is interfered with, it being somewhat irregular, and the irregularity being manifested by the formation of areas of thickening in the bone itself, while the cartilaginous portion is beginning to show fatty degeneration and extra formation of cells.

The chronic form of inflammation is characterized by new formation degeneration, or suppuration. The new formation is manifested by thickening or sclerosis of the part involved, degeneration by the tendency to softening and other conditions to which we will refer later, the suppuration by the formation of small abscesses or purulent infiltration.

The term necrosis is applied to the death of a portion of the bone as distinguished from the term caries which signifies death of a bone in particles, or to compare the bone and soft tissues necrosis corresponds to sloughing and caries to ulceration. The sequestrum is the portion of the bone which has died and is spoken of as exfoliating when it is thrown off.

Degenerative changes in bone are somewhat common. Rickets is a condition in which the ossification is interferred with probably as the result of some error in nutrition. It is a disease of childhood and the bones being very active at that period are very susceptible to nutritive deficiencies. The whole description of the disease in a nut shell has been ably given as an "exaggeration of the process of ossification but a failure to complete it." The line of ossification is quite irregular and the cells very indifferently distributed and of imperfect size and shape, the periosteal portion of the bone is quite soft and hence the bones are readily put out off shape. The bones as a whole are liable to different deformities such as enlargement of the epiphyseal portions

and the yielding of the bones when the pressure of the childs body is placed upon in the legs and the pelvis.

Osteomalacia is another disease of the bone which is a degeneration. The changes are very marked softening of the bones from some cause or series of causes which are not yet understood, but it is now supposed that it bears some relation to the pregnant condition seeing that it is commonly found among females at the puerperal period. It may, however, be present in other cases and also among males. The bone becomes so soft that they can be moulded at times with the fingers and thus the deformity possible at the period of parturition is great but of course open to changes seeing that they are soft. The structure of the bone seems to alter to the extent of the change which the absorption of the calcareous matter and the irregularity of the cells will induce. The whole of the structure is quite granular or gelatinous.

Atrophy of bone is normal in cases where the nutrition is interfered with or in the old age, but it takes place in cases where the causes are hard to understand making the bone brittle and very liable to fracture.

The fractured or injured bone unites by the formation of new bone consequent upon the changes which take place in inflammatory conditions.

The Periosteum is the tough fibrous membrane which covers the surface of bone externally; the membrane is made up of the two parts, the outer which is fibrous, and the inner which is more cellular.

The periosteum is subject to inflammation just like the bone and in fact often along with the bone. The acute form of inflammation may be of a simple type and characterized by swelling and infiltration, the exudation lifting the covering completely up from the pone and simply on account of the peculiar relation of the vessels (passing obliquely in the bone) the death of the bone may be prevented and the exudation absorbed. The inflammation may be acute enough however to end in suppuration and this pus may become encapsuled and remain between the bone and the membrane or the pus may decompose and the periosteum slough and the bone degenerate, the patient dying from absorption of the products or metastatic abscesses become established.

The chronic form is characterized bp the formation of areas of thickened periosteum which may become adherent to the bone. The tissue thus formed may be still further altered by the formation of bone within its substance or becoming entirely altered to bony tissue.

The inflammation induced by the syphilitic poison is of the nature of thickening, or the genuine syphilitic nodes, which may undergo suppuration or remain as caseous masses.

Tuberculosis is frequently met with as a chronic abscess formation with granulation tissue in which are tubercles and tubercle bacilli.

The tumors affecting bone may be referred to in such a way as to include

the periosteum at the same time, they are frequently affected at the same time.

The simple forms are :—Fibromata, which may be in connection with the periosteum or the medulla ; osteomata, either as an exostosis from the surface, enostosis from the inner surface, or hyperostosis when the bone is enlarged generally ; chondromata and angiomata. The malignant are sarcoma and carcinoma ; the former may be mixed with some of the simple varieties or else by itself and may be of different forms, the myeloid being the typical form associated with bone. The cancers are for the most part secondary or as an extension. The simple cyst is sometimes met with and so also may the dermoid.

DISEASES OF THE JOINTS.

In considering the diseases of the joints it is well to note that we have four different structures coming in contact at the joint and which are related to the condition of disease at the joints ; these are (1) cartilage, (2) bone, (3) ligament, (4) synovial membrane. The different diseases for us in this connection are mainly of an inflammatory character and the term arthritis is applied to the condition ; synovitis when the synovial membrane alone is affected.

The acute form may exist as in the course of some of the febrile diseases, such as acute rheumatism, or it may be the result of injury and is characterized by the swelling and congestion of the membrane without any exudation, when it is spoken of as a dry inflammation, or the exudation may be fibrinous with a very small quantity of serum, then the condition is known by the characteristic masses of fibrin floating around, or the exudation is serous then the cavity is filled with fluid. In any of these cases the condition may become purulent, or it may be purulent from tne first, the condition is then simply an an abscess in the joint. The structures may not be much involved, if so the condition may be overcome, but should the tissue be much involved, then the disease is likely to spread to the bones and set up destructive changes of a very serious nature. The tissues may slough or the whole part become gangrenous.

Chronic arthritis is found under different conditions, for example the condition which is clinically known as hydrops articuli is simply a serous inflammation of a chronic type, being characterized by the accumulation of serous fluid in the joint. We have another form where the synovial membrane is first involved but later the cartilage becomes eroded or ulcerated followed by the softening and destruction of the ligaments so that dislocations may take place. Again there is a chronic suppuration which may supervene on the above or stand alone where the structures composing the joints simply become disorganized, or we may have a form of ulceration in which the joints are involved.

The specific inflammations are more numerous in the joints than in some

areas of the body. The tubercular inflammation arises in the joint or is an extension from the bone. The tissues become swollen and pulpy with tubercles in the soft and degenerating material. The diseased condition may be sufficiently extensive as to involve all the joint and if somewhat slow and the swelling considerable the condition is referred to as white swelling, or pulpy degeneration of the joint. The bone may be involved and become destroyed by caries or necroses. In nearly all these cases the cartilage is ulcerated so that the joint rapidly becomes disintegrated. Gouty arthritis is characterized by the deposition of uric acid in and around the joints so that various forms of deformity result. The disease may be continuous for years and in that way many of the joints may have become involved. The joint is affected by changes similar to chronic inflammations. Rheumatic arthritis is mostly of a chronic type, the acute form being referred to as an acute inflammation. The changes taking place are thickening of the synovial membrane and adhesion or as it is termed ankylosis. The condition known as rheumatoid arthritis is characterized by the destruction of the cartilages at the center of the joint and the formation of dense spicules of bony tissue around the outer portion of the bone so that marked enlargement of the joint is apparent, and the part of the bone affected becomes quite hard or eburnated as it is termed. The neuropathic inflammation is found in connection with certain forms of nerve disease such as locomotor ataxia, or in the case of syringomyelia, the joint involved becomes suddenly deformed on account of the changes taking place which consist in the erosion and destruction of the center of the joint but without any peripheral zone of new formation as in the rheumatoid arthritis, or without the eburnation, in fact in this case, the bone becomes more like the rarefying osteitis. The conditions being similar to a certain extent to the rheumatoid arthritis some have tried to explain the cause for the difference in this way that they are similar only that the constant rotation of the joint in the one case presents the formation of the external zone of bony tissue which is quite easy formed, they think, when the rotation is absent, this elaborate reasoning is scarcely enough to disprove the theory so well made by Charcot. Syphilis sets up inflammatory changes which result in the thickening of the tissues or the cartilages may become eroded, or there may be a purulent effusion in the joint. The gummatous tumor may be in the region of the joint.

The joints are subject to injuries such as dislocations or wounds, but there is nothing necessary to descrbe in either of the conditions further than the fact that they occur.

Some congenital deficiencies exist also but they are usually of the nature of dislocations and so require no further mention, seeing that the question of their origin does not require to be settled at this particular place.

The tumors of the joints are usually secondary and may be of any variety which can be found in the tissues adjacent. The tissues within the joint

may become enlarged and form the little swellings on the synovial fringes but they are not of much significance apart from the relation they bear to the foreign bodies (the loose cartilages) which are sometimes met with in the joint. They may be either fibrous, cartilage or bone, depending on the change which these fringes have undergone before they became separated from the membrane. It is quite possible that these bodies may be formed by the separation of some part of the articular cartilage, or as the result of a caseous mass following an inflammatory process.

DISEASES OF MUSCLE.

The muscular system is composed of the two different varieties of muscle fiber, both of which are liable to disease.

VOLUNTARY MUSCLE. The inflammation may be acute, chronic, or suppurative. The former is frequently the result of an injury or as an extension from some other tissue. It is characterized by swelling and effusion with some infiltration of cells into the tissues around. The effusion may be simply serous when there is considerable softening on account of the quantity of fluid present, with more or less degeneration of the muscle fiber; or the inflammation may be more intense and spoken of as hemorrhagic inflammation, the infiltration is hemorrhagic in nature and the condition is more grave than the last; or it may pass into another type where the inflammation is suppurative, in other words, there is the formation of an abscess in the muscle. The suppuration may be localized, or diffuse, result from the same cause referred to, or from septic products in the blood, and result in the destruction of considerable tissue. The inflammatory changes in muscle frequently appear without any apparent cause in connection with some forms of infectious diseases.

Chronic inflammation may be of the nature of a new formation where the connective tissue is formed between the fibers, being extremely granular, but later becoming cicatrical; or it may be that the new formation may become osseous, forming what has been spoken of as, myositis ossificans. The muscle affected in whole or in part becomes bony and hard, it is illustrated in the case of those who are constant horse riders, the adductors of their legs becoming quite rigid, it is seen also in cases where the muscle swells and takes on the appearance of a tumor. The chronic change may be found also in the shape of a continuous suppuration chiefly in association with tuberculosis.

The tubercular inflammation results in the formation of tubercules and the syphilitic in the formation of gummata in the muscle substance.

Degeneration in muscle fiber is frequent as has been already suggested in the part on degeneration in tissues generally. Atrophy of the muscle may arise from simple want of use, or it may be that it is quite pathological, as in the case of progressive muscular atrophy where there is degeneration of the fibers along with an interstitial inflammation so that the muscle eventually

becomes almost, if not altogether, connective tissue. The muscle nuclei pro-
liferate and the whole tissue is granular in appearance. It is the result of
disease of the anterior cornua of the spinal cord. The lesions in the cord may
be followed by atrophic changes of a degenerative type, they are referred to
as secondary. We have the pseudo-hypertrophic condition of muscles which
is really an atrophy of the fibers, probably as the result of a spinal lesion
but not definitely understood, in which the fibers are atrophied and the en-
larged tissue consists entirely of fibrous tissue with some fatty cells be-
tween.

Other forms of degeneration are albuminous, in cases of acute febrile con-
pitions or inflammation; fatty degeneration, in cases of chronic diseases or
poisoning by phosphorous; amyloid; and hyaline, which is common in cases
of typhoid fever.

The tumors are in the connective tissue portion usually and are either
simple or malignant. The simple are fibroma, chondroma, lipoma and oste-
oma; the malignant sarcomata either primary or secondary in different forms
and the carcinomata as a secondary condition only and even then rarely.

The parasitic affections are chiefly the condition referred to as trichino-
sis, some others exist but they are rare and insignificant.

INVOLUNTARY MUSCLE. The involuntary muscle fiber is liable to all the
inflammatory changes that other muscle fiber is subject, as also to degenera-
tive changes and tumors. These changes are seen in such muscles as the
walls of the uterus which when inflamed may become soft and swollen, if acute
enough purulent or even purulent all along as in the puerperal state where
infection has taken place. The chronic form of inflammation leads to thickening
of the walls and consequent hardening.

Degeneration is seen at times of the nature of calcareous deposits, the
whole organ becoming quite solid just like a mass of lime, so much so that
cases are reported where the organ "fractured" under certain conditions. The
normal lessening of the organ is probably an atrophy of the muscle cells some
think numerical.

THE DISEASES OF THE SKIN.

In connection with the diseases of the skin it is necessary to remember
that the skin has quite a few appendages which are considered along with the
skin. The skin being situated on the surface of the body and in such close
communication with the blood supply and the nerve terminals becomes very
liable to irritations from without at the same time subject to many conditions
arising from within through these channels. In the consideration of these
diseases certain terms are applied which are significant, perhaps not so much
as a matter of pathology as a matter of clinical interest; for example the term
papule is applied to a condition where the skin is somewhat elevated in small
patches and the area around inflamed; vesicle where the localized swelling ex-

ists but in the apex of it there is some serum ; pustule where the serum present in the case just mentioned has been replaced by pus. Other terms are bullae (or bleb) where the cuticle is elevated and the space full of watery serum; squama (or scales) where the cuticle becomes hard and rubs off in scales ; macula where the skin is more or less affected by the formation of small spots of pigmentation ; tuberculum (tubercles) where small tumors or nodules exist and exanthemata where the characteristic rash appears in cases of the eruptive fevers.

The skin being as above stated so much influenced from without and within is very liable to inflammatory changes of various kinds, we might classify these according to the nature of the causation, for example, simple inflammations, specific inflammations, symptomatic inflammations and traumatic inflammations.

The simple form of inflammation is illustrated in cases where the skin has been exposed to the rays of the sun setting up a dermatitis which is characterized by redness, some swelling, later by desquamation ; or it may be seen in cases of irritation where the irritation is not sufficient to constitute traumatism, the same symptoms of redness and swelling being present, only more localized. If the redness and the swelling be general the condition is spoken of as erythema. Another form of simple inflammation is spoken of as eczema, which is a localized inflammation usually of a chronic character. There are several forms of eczema and the terms applied to it indicate simply the character of the inflammation, for example, eczema papulosum, eczema vesiculosum, eczema pustulosum ; the condition being similar in each of these cases but differing simply in intensity. The cause of the disease is very obscure, some consider it as always due to constitutional conditions, others that it is partly constitutional and partly external irritation. As already indicated the disease is usually chronic when the characteristics of the lesion are infiltration of cells and thickening in some cases the skin being almost cicatricial ; sometimes the disease is acute and in that case the lesion is usually more of the nature of a watery discharge which passes off and leaves the skin practically normal.

Psoriasis is another simple form due to some condition as yet undiscovered, acting upon the external layer of the skin usually, which becomes somewhat hyperemic, with considerable proliferation of epidermic cells. The amount of proliferation is manifested by the abundant separation of the peculiar silvery scales characteristic of the lesion. Prurigo is a simple inflammation of the papillae causing them to enlarge and as a consequence excites the nerve terminals sufficiently to produce the itching which is so characteristic of the lesion.

Pemphigus is a simple inflammatory condition characterized by the accumulation of serum in unilocular blebs of considerable size immediately beneath the epidermis. If the bleb ruptures usually crusts form but the sur-

rounding epidermis remains practically unaltered. Another form of a simple inflammatory nature is sometimes found in cases of continued high febrile conditions, which is characterized by a diffuse formation of minute vesicles, which if unassociated with redness is spoken of as sudamina, if there be some redness surrounding the vesicle it is then spoken of as miliaria.

The specific inflammations are those due to the action of some specific virus, a good example of this is found in cases of cadaveric poisoning on the hands of those accustomed to perform post mortem examinations. If an abrasion of the skin allows infection to take place. acute inflammation follows and a pustular condition soon develops. The inflammation may be acute enough to produce sloughing when the constitutional symptoms being overcome the destroyed tissue is replaced by new formed tissue, or it may be that the skin becomes nodular or tuberculated. These are the local changes without reference to the general changes which take place if pyemia results from the purulent condition. Another specific inflammation is known as erysipelas in which if the condition be somewhat mild the skin alone is involved, should the condition be more severe (this is usually the case) the cellular tissue beneath the skin is also involved. The tissues affected become swollen and soft, owing to the infiltration of cells and the exudation of serum, sometimes forming accumulations of pus. It may be where the inflammation is extremely acute that sloughing takes place, this is usually seen around the edges of septic wounds and has been sometimes spoken of as phlegmenous erysipelas or acute acute spreading gangrene.

Another common infective condition is anthrax which appears on the skin after the innoculation of the poison as a small pustule, the pustule soon ruptures and the wound is surrounded by a zone of smaller pustules and a black eschar in the center with the characteristic red area around the outer margin of the ulcer; it is common to speak of the condition as malignant pustule. The constitutional symptoms are well marked and the patient usually dies from the absorbtion of the septic products There are several other forms of specific lesions of the skin which we need scarcely take time to describe, such as leprosy, glanders and lupus. Lupus being, as we have already mentioned, a cutaneous form of tuberculosis. The syphilitic lesion is a specific inflammatory affection which is produced by the activity of the syphilitic poison. The chancre has been explained. as also the form referred to as chancroid. We have a form of eruption appearing on the skin, which is simply due to the irritation in the skin of the products in the blood. and the lesion is almost similar to the ordinary erythema referred to in simple inflammation with this exception that the eruption is due to a specific poison and that the tendency is to the formation of granulation tissue in the part which is affected. The condylomata or syphilitic warts are due to the irritation in the papillary layer of the skin and the consequent development of tissue as the re-

sult, they may continue as simple warty enlargements or they may ulcerate. The gummata are formed underneath the skin also and are similar in the same condition elsewhere.

The symptomatic form of inflammation is seen in the case of the eruptive fevers in which the irritation produced by the fever results in the erythema or modified erythema which is characteristic of each febrile condition. The small-pox eruption is quite characteristic and may be explained as being the result of a more severe irritation and consequently there is more of an inflammatory action. The epidermis is the chief part affected, the cells undergoing a necrosis in which fluid accumulates. The accumulation takes place in such a way that the space is multilocular and around there is quite an infiltration of cells the whole of the part affected may undergo necrosis which accounts for the peculiar pitting which takes place after the small-pox eruption. If the necrosis be more limited and cease when the exudation has taken place into the tissues then the crust is formed and when it is thrown off there is no loss of substance consequently no pitting.

Traumatic inflammations may be met with also but they are included really in connection with the other forms seeing that they may be either simple or specific.

The skin may be affected by lesions of the nerve centers or nerve fibers. The condition referred to as herpes is an example of this in which there is a peculiar formation of vesicles along the course of certain nerve fibers as in the case of the intercostals. The symptoms are of inflammatory nature which is quickly followed by the appearance of these vesicles. It is met with in cases of locomotor ataxia, injuries to the nerves and disease of the brain. Then we have the peculiar glossy appearance of the skin in cases of central nerve disturbances where the skin becomes quite shiny. Again we have the condition referred to as scleroderma in which certain limited areas of skin become hard and almost ivory-like in whiteness. The lesion seems as if it were an atrophy along with chronic inflammation.

The skin may become increased in thickness in certain localities as the result of continued friction and the condition is spoken of as a hypertrophy or "callosity." The change has taken place in the external layer of the epidermis. The difference between a callosity and a "corn" which is a localized hypertrophy is that the lesion is limited to a smaller portion of the skin and the constant pressure from without has made the callosity grow down into the true skin and so we have the corn and an explanation of the pain accompanying the corn. The skin is sometimes the seat of a general hypertrophy of the outer layers in such a way that the peculiar formation spoken of as fish-skin or ichthyosis results. It is generally supposed to be some congenital lesion which is hereditary at least to some extent. The outer scaly epidermic cells are hypertrophied and arranged in such a way that the im-

brication characteristic of fish skin results. The cells are somewhat altered also having some sebaceous matter in their substance. The ordinary wart which is met with on the skin is simply due to an increased development in the papilla. Naevi have been referred to in connection with the vascular diseases.

The tumors of the skin apart from these conditions just mentioned are either simple or malignant. The simple are lipoma, chondroma and osteoma; the malignant are sarcoma and carcinoma. The sarcomata are usually primary and may be either round or spindle celled, at times they are melanotic, that is pigmented. The cancers are usually present as epitheliomata, or rarely as an ordinary cancer which may be pigmented.

The skin is the seat of vascular disturbances either of the nature of a congestion, or hemorrhage. The congestion may be acute in the case of febrile disturbances already mentioned, or passive in connection with vascular obstructions in which the appearance is a well marked cyanosis. Hemorrhage is common in some forms of disease, for example typhus fever, scurvy, purpura and small-pox; being due in these cases to the condition of the blood. The changes which the blood undergoes in the skin are well known and well seen in cases where the skin has been injured and are due simply to the blood being changed in the process of absorption. In connection with vascular changes edema requires to be mentioned; it is a condition in which the fluid portion of the blood collects in the lymphatic spaces, and is frequently met with in cases of disease of the heart and kidneys.

The appendages of the skin are also subject to disease. The glands are sebaceous and sudoriferous. The sebaceous glands are distributed where the hair is developed and we quite frequently find that the ducts become obstructed and we have swellings due to the retention of the normal products of the gland affected, these are spoken of as "wens", are common on the head, being due to some cause associated with heredity because they are almost always found in certain families. The contents are epidermic cells, fatty debris and sometimes crystals of cholesterine. On the face we find a condition referred to as acne in which the sebaceous follicle becomes obstructed and filled up by secretion, the secretion appearing at the orifice as a black speck which gives rise to the term black head, often applied to the disturbance. The contents when squeezed out come like a worm and so the reference to the "worms" which are supposed to come from these spots is understood. The area around the spot is somewhat inflamed as a rule, then the term comedo is applied, should no inflammation exist or black spot be visible, but simply an elevated spot on the skin be apparent, then it is referred to as a milium.

The peculiar formation spoken of as acne rosacea seen on the nose is a condition where the sebaceous glands are somewhat inflamed and the blood vessels hypertrophied. The skin becomes thicker and hence the peculiar ap-

pearance of the nose in these cases. It need not be that the person is dissipated in habits in order that these symptoms may develop, because they are found in cases of disturbed function at the period of the menopause, without any question of any dissipation.

The hairs may undergo changes which are usually spoken of according to the effect, in other words the hair may disappear altogether or simply undergo a change, the former is alopecia, the latter changes in color or appearance. The falling out of the hair, which causes the bald condition, is due to some atrophic change in the papilla. The hair falls out normally in health but the papilla remains active and new hairs replace the old, but as the senile change advances the hair coming in place of the last becomes finer and more woolly until they ultimately cease to appear at all. The cause of this change in the papilla is not clearly understood, but it is known that in some febrile diseases the hairs fall out and similarly in syphilitic disease it is probably some nutritive change, it may be as some think parasitic. The latter view would seem to merit some attention seeing that cases exist where the hair comes out in patches; it may be that it is due to some nerve influence. The change in color is due to the deficiency in the amount of pigment at times but may be produced by the entrance of air into the cortical portion, separating the cells from one another, perhaps that is the cause of sudden changes in color.

The nails are affected by disease as is well shown in cases of severe illness when the lines are apparent from the time the illness began.

The parasitic diseases of the skin are fairly common. We have several forms due to fungi, for example, the disease spoken of as ringworm. This disease is found on the scalp, face or body, and is due to the activity of the fungus Tricophyton Tonsurans. The lesion differs slightly in appearance on each of these different situations, but the fungus remains the same. The characters of the fungus are many mycelia or threads passing between the epidermic cells with very few spores. Another form of disease due to the fungi is found on the scalp and skin, generally due to the Achorion Schoenleinii. The lesion is characterized by crusts in which the mycelia are found with many round spores in rows. Still another form is met with, due to the activity of the Microsporon Furfur, as scaly crusts in which the mycelia are abundant, but the spores which are also round in bunches like a mass of grapes.

The disease due to the Acarus scabiei is known as the itch. The lesion is seen to consist of furrows in which are found the insects covered over by the external portion of the epidermis, under which they have practically secreted themselves. The insect may be found in small vesicles or pustules raised by the irritation of the insect. The full grown male is smaller than the female, they have eight legs, a projecting head and a round body.

THE ANIMAL PARASITES.

The human body is frequently the seat for the development of changes depending upon the presence of animal parasites. We have referred to some which are found on the surface of the body, but we refer now to those within the body, of which there are several different forms, for example, the tape worm, the round worm and the flat worm, or as they are scientifically called, the Cestoda, the Nematoda and the Trematoda.

The Cestoda exist in the system both in the mature and also in the embryonic state. When mature, the worm is elongated and made up of segments joined together, each of the segments being hermaphrodite (that is both the male and female element are present in one,) and attached to a head from which they grow. The head has several suckers and sometimes hooklets by which they suspend themselves, the segments as they get ready to leave their first habitat, separate themselves off at the further end from the head and pass off in the excreta when they are swallowed by some animal in food or drink and develop if the animal is fitted for that purpose. When swallowed the digestive process sets the embryo free and it reaches the part suited for its development by perforating the walls of the intestine, it then remains in that position until it is eaten by the individual in the flesh of the ox or the pig and then it develops into the true cestoda or tape worm. There are several forms of this parasite, but the most common is the Taenia solium which we have been referring to mainly in the description given. It has four suckers and a double row of hooklets.

The Nematoda or round worms are of various types, all belonging to the same order however. They have a mouth, alimentary canal, are unisexual and are parasitic during part of their existence only. The common round worm which is met with so frequently is a good example of the group. They are of considerable size and resemble the ordinary earth worm. in fact it is considered probable that they are earth worms swallowed. The worm is usually found in the small intestines but may be in any part of the intestinal tract. The thread worm is also one of this group, they are very small and found frequently in children. The Trichina spiralis belongs to this group also. The disease spoken of as trichinosis is due to the worm getting into the muscle, coiling itself up and becoming encapsuled. The Filariae sanguinis hominis are small embyonic or adult worms found in the blood, urine and some other fluids in cases of chyluria.

The Trematoda are small, flat shaped worms or parasites, they have two sucking discs, one of which is on the side, the other at the mouth. They have an alimentary canal but no opening to it except the mouth. They are hermaphrodite and are subject to many changes before they reach the adult stage or enter the adominal organs of their host. There are several forms of the parasite, some of them very rare. The commonest of all perhaps is

the Distoma hepaticum or the parasite which causes the destructive disease in sheep known as the "rot."

The Hematomonas malariae is another form of parasite which is met with in the case of malarial fevers. It is found in the blood usually with considerable ease at the time that the chill is approaching, its presence is an absolute guide to the diagnosis of the condition and for that reason ought to be looked for. The organism varies at different periods during the attack of the fever, at first they are small, pigmented, intracorpuscular bodies, later they are crescentic and extracorpuscular sometimes with flagella. In order to find the organism it is necessary sometimes to stain the blood although they may be found without staining in some cases where the blood is fresh. To stain the blood take a small quantity of the blood, fix it in alcohol for two or three minutes, place in stain for five minutes, wash in water, dry and mount in balsam. The stain that is used is known as Plehn's and is made as follows:—

Saturated aqueous solution of methylene-blue,	60 c. c.
One half of one p. c. solution of eosin in 75 p. c. alcohol,	25 c. c.
Distillied water,	40 c. c.
Twenty p. c. aqueous solution of sodium hydroxide,	12 9tt.

THE CHANGES IN TEMPERATURE.

The bodies of individuals have a certain fixed degree of heat which depends somewhat on the individual. The mormal temperature ranges from 98 ° to 99 ° but on an average is about 98.6 °, it is variable in the course of the twenty four hours and in the particular circumstances associated with the recording of it. The temperature is due to the metabolic changes going on in the tissues of the body, and its maintainence depends on the influence of the centers in the brain which control the amount of dispersion taking place. The exact relation of the nervous system to the production and dispersion of heat is not very clearly understood but it is certain that some relation between the conditions exist.

The abnormal conditions associated with temperature may be described as diminution or subnormal conditions, and increase or pyrexia, which indicates a febrile condition. The subnormal temperature may be produced by severe loss of blood, shock, certain poisons and in cases where the temperature has been considerably elevated for a length of time as in pneumonia or typhoid fever. The explanation probably being that some interference has taken place in the production of heat, or else that the control of the dispersion has been partially destroyed.

The condition referred to as pyrexia is of frequent occurrence and due to several different causes. There are several different terms applied to the increase in temperature simply indicating that the various degrees of elevation are recognized, for example, pyrexia, where moderate elevation has taken place, or hyperpyrexia, where the elevation is very well marked. The causes

for the increase may be classified as (1) the products of bacteria, well seen in cases of diphtheria or septic absorption where the symptom of fever is well marked; (2) tissue changes, where the elevation is due to the absorption of normal tissues of the body as in cases where simple fracture of the bone has taken place, there being no question of septic products, or bacteria having reached the injured spot; (3) anto-infection, as in cases of anaemia in girls where the condition of the blood is very much altered and the elevation of temperature is well seen; or (4) neuroses, as in cases where the severe chills and high fever follows the passage of a catheter or, if some should think this condition due to infection, in cases of injury to the brain or in diseases of the brain.

The changes which take place in the febrile state are constitutional and general. The constitutional are the impaired condition of digestion, of mental activities and the general are the influence upon the blood and the blood stream. The question in regard to the increase or diminution in the blood pressure is considerably over estimated seeing that the blood vessels being in a dilated condition will only allow the blood to flow through them easier but not raise the pressure. The quality of the blood is altered in some cases being more concentrated, in others being more dilute.

The effect of the febrile state has been very much over looked in the past. It is quite true that some of the effects are of the nature of serious degenerations, some of these being granular infiltration of organs and tissues, after the febrile condition, others are fatty degeneration and necrotic changes, but it is certain that the influence of the febrile condition for good is also considerable. When we consider that the diseases in which we have high fever are due to micro-organisms of great resistance to high temperature the influence of the febrile state as nature's method of destruction becomes somewhat clear. We know that the development of the bacteria sets free certain varieties of substances which are used for the purpose of combating diseases and that these bacteria in their development in the blood and the tissues can be successfully, in some cases at least, overcome, then we may well consider that the high temperatures are beneficial, in that they destroy the invading germs partially by the elevation of temperature and partially by the development of these toxins within the body of the individual attacked and consequently not waiting for the introduction of these artificial toxins. The influence this view has upon the course of febrile diseases is of very great significance to all thinking and scientific investigators.

THE MICROSCOPE AND ITS USES.

The study of the structure of the tissues in health or disease can only be accomplished with the aid of the finest and best adjunct that the researches of man has ever placed at the disposal of his fellow man. The statement has been made that the study of the infinitesimal reveals to the mind of man as much

that was hitherto unknown as the study of the worlds which encircled our world without our knowledge until the telescope revealed the fact of their existence to our infinite minds. The truth of the statement is unquestioned and is made possible only by the use of the instrument fitted for the magnification of the things that exist but in such infinite degrees of minuteness that several hundred times of magnification become necessary to bring them within the scope of our vision. We can scarcely conceive the position of the pioneers in the study of tissues before the microscope was within their reach. The researches of the originator of the instrument, as we now know it, can scarcely be ranked along with the possibilities of the instrument used today, yet we know, and with all honor it should be told, that the original desciption of the micro-organisms which were given by him have not been surpassed or in any degree improved. When we hear of the imprecations made against all that tends to a better and more scientific basis for the study of diseases we are forced to wonder if the great anxieties of the noble champions of the past are overlooked, if they are forgotten and their work of no avail. Some would have us believe that only the great, in position, can introduce the best that we know, but this does not correspond with the history of the ages, think of the industrious but poor grinder of lenses introducing the revolutionizing instrument of the world, and this not even in the nineteenth century but in the seventeenth (1675) when nobody looked for anything.

The microscope consists essentially of an arrangement of lenses in such a way that magnification becomes possible, all the rest of the instrument being accessory to the instrument for the purpose of increasing its adaptability and ease of manipulation. It is not necessary to mention any special form of microscope as being superior to another but the one selected for use should have all that will give the operator the benefit of the magnification which is requiste in the study of the tissue, particularly the micro-organisms. The instrument itself has a base of reasonable weight so that the balance of it in manipulation is not a matter of concern; upon this base a support is placed for the rest of the instrument and by this part of the instrument it should always be lifted so that the delicate portions of the mechanism may not be destroyed. The instrument is attached to this upright by a hinge which allows the adjustment of the instrument to any position considered advisable, at this level on the movable part of the mechanism is situated a stage upon which the specimen for examination is placed having a central aperture for the reflection of the light up against the specimen from the mirror which is attached by a universal joint below. This aperature is usually guarded by a diaphragm arranged with an iris attachment for the purpose of increasing or decreasing the amount of light as the operator finds necessary. The tube of the microscope which contains the lenses is attached to this part of the instrument directly above and in the same line as the support already mentioned

and is supplied by a fine screw arrangement so that the position of the tube can be altered with very great accuracy; immediately in front and usually above this fine screw there is a coarse screw arrangement which is placed there for the purpose of bringing the objective in relation to the object before adjusting the finer screw. The tube or barrel can be drawn out so as to increase the distance between the lenses, the distance being carefully calculated and marked on the side as a rule. The opening in the upper end is fitted by an eye-piece which is an arrangement of lenses for the purpose fittted in a case so that it can be readily withdrawn and another one substituted. The lower end has attached to it the objective which is also a series of lenses fitted in a case for the purpose of easy removal and at the same time carefully calculated for particular possibilities in manipulation; the terms two-thirds and one third of an inch being applied to those most commonly used, the former being the ''low'' power, the latter the ''high'' power. Other strengths are used at times, such as the one twelfth, etc.

The microscope requires to be carefully used, so that having referred to the mechanism of the instrument we will just give some few instructions in the use of the instrument.

The microscope is kept carefully closed in the ''box'' fitted for it and when required is taken out and placed in front of the person, in such a way that the rays of sunlight are not in the line of the ''mirror'' but that a good light is available either artificial or natural; the attachments referred to as eye-piece and the objective are put in position, the object on the stage and the tube lowered sufficiently to be within range of the object without risk or injury. The power should always be used first until the general outline of the object is understood, then if the further aid of the high power is necessary the low power is removed and the high put in position, to do so it is a good rule to reverse the fine adjustment half or an entire turn so that the risk of injury to the object and the objective is obviated. The only thing necessary in the use of the microscope is care and practice, if these points are attended to and assiduous care and attention paid to the manipulations then its use is simple, should negligence be allowed the instrument is injured, the object destroyed and no results are obtained.

The microscope is of very great use to the general practitioner in the case of urinary disturbances, diseases of the blood and in cases where parasites or micro-organism are in question, apart from the utility in the diagnosing of tissues which have been the seat of certain forms of disease. We will refer to these conditions and explain some of the commoner conditions met with which it may be necessary to consider.

THE URINE. The analysis of urine has been quite satisfactorily dealt with in other departments and we do not now take it up but refer simply to the microscopic aspect seeing that as a matter of pathology it requires to be

considered in this connection. In order to get the proper specimen of urine a quantity is collected in a conical vessel, protected from the dust and allowed to stand, or else as is more frequently done at the present time, a mechanical arrangement spoken of as a centrifuge is used for the purpose of separating the sediment from the fluid at the particular instant of time that the examination is to take place. When it is considered advisable to keep the urine for some time it requires to be preserved. this is done by the addition of some substance like chloroform, iodine, or thymol. The sediment can be preserved by the immersion of it in saturated solution of acetate of potassium then withdrawing the fluid when ready to use. The sediment is frequently stained by the addition of some staining solution for the purpose of bringing the characteristics of the deposits out clearly. When the sediment is ready a small pipette draws of a sufficient quantity to place on the glass, it is then covered by the ordinary cover glass, the excess of fluid removed by blotting paper and examined, using the lower powers of the microscope for the purpose.

The deposits in urine are usually classified according to the nature of the materials present and the chief divisions are (1) organized and (2) unorganized; the former include epithelium, pus, blood and the microgranisms; the latter the crystaline and amorphous salts. The organized, as we have indicated, include these cellular structures which we will briefly mention, simply to indicate their significance and their recognition.

THE ORGANIZED PUS. The urine is cloudy and contains albumen. The cells are considerably larger than the blood cells, are pale, granular, and multinucleated, this latter nucleated appearance being more intensified by the addition of acetic acid.

BLOOD. The characteristic appearance of urine with blood is variable and may show no indication of its presence at all, this being particularly so in cases where the hemorrhage is slight and comes from the kidney. If it come from the urethra, the bladder or kidney in quantity the urine may be colored red. in fact there may be some blood-clot, but if the quantity is moderate the color is usually somewhat smoky. The recognition of the cells by the microscope is not difficult if the changes which take place in the cell when exposed to the action of watery solutions be kept in view; if the specific gravity is high they contract and shrivel up, if the specific gravity is low they swell and burst. The chemical tests for the blood should be applied and the test for the formation of crystals of hæmin. The significance of blood in the urine depends to a great extent on the cause. so that it should be located if possible. The blood may come from any part of the tract in cases of inflammation of the kidney, congestion, malignant disease, or injury; in calculi in the pelvis of the kidney or ureter; in diseases of the bladder such as calculi, congestion, inflammation, ulcers and tumors; in injuries of the urethra and in cases of females from the uterine discharges.

Mucous. The mucous is found as amorphous particles mixed with epithelial cells and is present in nearly all normal urines, but in cases of catarrh of the urinary tract the quantity is considerably increased. It is soluble in alkalies, precipitated by acetic acid and has to be considered in cases where the urine is acidified for the recognition of albumen; to overcome this difficulty the urine is filtered to remove the mucous first.

Epithelium. The epithelial cells found in the urine differ from one another, the difference depending on the locality from which the epithelium comes. The epithelium from the urethra and bladder is oval or somewhat round, from the vagina it is squamous, from the pelvis and ureter it is irregular or spindle-shaped, being somewhat like the cancer cell and by some supposed to need differentiation from it, but the cancer cell is by no means characteristic enough to require consideration in this connection. The epithelial cells may be degenerated, either swollen, shriveled, or in a state of fatty degeneration. The only form of epithelium which is of real clinical significance is the tubular form coming from the tubules of the kidney.

Casts. These are found in cases of congestion or inflammation of the kidney and are of more importance on that account than some of these other forms of organized materials which may be found in the urine. They are supposed to arise from the exudation of the serum of the blood into the tubules and the coagulation of it in that situation, or the desquamation and the degeneration of the epithelium. These casts are much easier found if the specimen be stained by some of the staining reagents like methelene blue, or, in fact, any color that is convenient provided that it is very dilute. The recognition of them is fairly easy provided that the foreign elements which gain an entrance into the urine are understood, some of these are cotton fibres, hair, and any of the appliances which are used in the preparation of these specimens. There are several varieties of these casts found, each of them having their own significance.

The epithelial cast is a mass of epithelial cells arranged in a column of a size and shape compatible with their origin in the tubules; the cast is usually fairly wide.

The granular cast is a solid column dark and quite granular in appearance. They may contain fat and blood cells.

The hyaline cast appears as a transparent cylinder which may appear only after the use of the stain, they are variable in thickness, the fine ones being usually longer.

Another form is referred to as false or spurious casts where the cast is made up of the unorganized materials such as the crystaline or amorphous substances. Others are composed of masses of micro-organisms, others of blood.

The significance of these casts depends on the continuance of the condition, for example in congestion of the kidney hyaline casts are present but

as the congestion passses off the casts disappear. The cast composed of epithelium and blood would tend towards the diagnosis of an acute inflammation of the kidney; if granular with contracted epithelium and some fat it would probably be chronic.

The remaining organized materials which may be found in the urine are the micro-organisms; the most common being the moulds, the yeast plants and the true bacteria, such as the bacillus tuberculosis, the gonococcus and the pyogenic bacteria. In addition to these the filaria sanguinis hominis is sometimes met with.

THE UNORGANIZED DEPOSITS. These are present in the urine and at least in many of the cases do not indicate any diseased condition but some functional disturbance.

URIC ACID. The crystals of uric acid are present in acid urine forming usually after the urine has been voided, if before, the urine is very acid and the urine is full of particles of red matter which have been referred to as "cayenne" on account of the resemblance to that variety of pepper. The crystals are usually colored and are very variable in shape, either lozenge, dumb-bell, rosette, or barrel. The crystals are soluble in Potassium hydroxide, and reprecipitated by the mineral acids.

THE URATES. They are very common and not of much importance. They are increased by a meat diet, diminished by a vegetable diet, and are thrown off in casss where acute febrile diseases are present such as pneumonia and rheumatism. They are usually precipitated when the urine cools, on account of the lesser degree of solubility in cold as compared with heat. The color varies being white, red, or pink. They are present in combination with sodium, potassium, ammonium and calcium. The urates may be in the form of an amorphous deposit, or as crystals of different shapes.

THE OXALATE OF LIME. The oxalates occur as colorless crystals in octohedral or dumb-bell shape. They are distinguished from the phosphates being insoluble in acetic acid; from uric acid being insoluble in alkalies but in soluble mineral acids.

THE PHOSPHATES. They are present in alkaline or feebly acid urine. The commonest form met with is the triple phosphate, or as it is called the ammonio-magnesian phosphate. In this combination it is found in rhombic prisms, sometimes the feathery phosphate, particularly if it is artificially precipitated. The crystals are instantly dissolved by acetic acid, which distinguishes them from the oxalates. The ordinary phosphate of lime is present sometimes as star shaped colorless prisms. They are referred to as the stellar phosphates.

CYSTIN. This is a rare form of crystaline plate which is sometimes present in the urine, the plates are usually hexagonal (that is six sided) and are distinguished form the uric acid partly by the shape, and the absence the want of

color. If the crystals are difficult to find add some acetic acid then the crystals are thrown down. The significance of these crystals seems to consist only in the fact that they may lead to the formation of a calculus. The causes at work in their production are unknown, some think they are hereditary.

Leucin and Tyrosin are two very rare crystaline deposits which are met with in urine, the former in globular crystals, the later in needle crystals or sheafs, They are met with in cases of acute yellow atrophy of the liver and some say in cases of smallpox, acute tuberculosis and some acute fevers. The significance is not well understood.

THE BLOOD.

The examination of the blood by the microscope is for the purpose of estimating the relative proportion between the cells of the blood, the abnormal constituents of blood and sometimes for the purpose of diagnosing diseases from the conditions present. The blood may be examined either in the fresh condition or the specially prepared condition, the later always whether the former is attempted or not, seeing that more information can be gained from it. The blood should be taken from a portion of the skin perfectly cleansed and then spread on the slide for the fresh examination. To make an examination of prepared blood the blood is either heated for 15 or 20 minutes in a temperature of 115 ° C, or the cover glass having been covered with blood is immersed in an equal-part solution of alcohol and ether for two hours then dried and stained. It is not necessary to go into the forms of cells found in normal blood, that is really a matter for the histological department, but it is important that the fact is recognized that several different forms of cells are found in the blood in addition to the red and white of the older writers. The relative proportion existing between the red and white cells is made out by the use of the specially prepared adjunct to the microscope of a Hemocytometer. The essential of the mechanism is the hollow chamber which is carefully calculated so that a certain quantity of blood sufficiently diluted is placed in the space within the slide, and the number of the cells counted on a number of the squares which the bottom of the chamber is divided into. The blood is dilut ed one hundred times and as much of this as will fill the chamber is put there, then the numbers noted say on ten squares, take the average of the numbers and multiply by one hundred (the amount of dilution of the blood) and then by four thousand (the actual space in the chamber in fractions of a c. mm.) the sum is equal to the number of cells in the c. mm.

The abnormal constituents of blood may be the parasites which we have refferred to in connection with malarial fever and explained in the paragraph on the animal parasites; or the bacteria of certain diseases may be present, for example the bacillus tuberculosis and the bacillus of anthrax. The bacillus of tuberculosis will be mentioned in connection with the examination

of sputum and so need not be mentioned further at the present, but the bacillus of anthrax is found with ease in the fresh blood or after staining. The most modern development in blood examinations is the searching for the bacillus of typhoid fever by the process which has been described by Widal. The process briefly described, consists in the taking of a drop of blood form the ear or finger this is mixed with a drop of sterile water, to this is added six drops of the culture solution (see later what this is) and a drop of this solution is placed on another sterile cover glass and examined when the bacteria get into bunches and loose their power of movement; if this reaction does not take place then the blood is considered free from the bacillus. The culture solution referred to is made by innoculating an agar-agar solution, allowing it to develop for twenty days then innoculating neutral beef bouillon and allowing incubation at a temperature of 98 ° F. for twenty-four hours or the agag-agar solution may be mixed with sterile wrter. The benefit of the experiment is of importance seeing that the typhoid disease can be diagnosed from their presence.

The staining of the blood is usually conducted after the methed of Ehrlich. The formulae is complicated and will be found in any of the books of Pathology, or can be made up by any reputable chemist.

An easy method of staining is to prepare the following and use it:

Methylene-blue saturated aqueous solution	40 c. c.
Eosin, half per cent solution in 75 per cent alcohol	20 c. c.
Distilled water	40 c. c.

The specimen for examination is stained for three or four minutes, or else putting the cover glass with the blood fixed as above in the solution and heating in an incubator at 98.6 ° F. for an hour. These being what are termed the rapid and and the slow methods.

THE SPUTUM.

The examination of sputum is one of very great importance in the diagnosis of the affections of the lungs, perhaps no condition exists which gives more room for doubt than the diseases of the lungs and in case the condition is at all serious, as it often is, the diagnosis is of the utmost importance to the patient as well as to the attending practitioner. The first thing to consider is the collection of the sputum, this requires some care and attention in order that the result of the examination be not interfered with; the sputum should be collected in a sterilized jar, the solid particles picked out and placed on the slide for examination directly; or the sputum may be collected for one day and boiled in a solution of caustic soda, when boiling pour some cold water into the mixture this carries the lung tissue down to the bottom of the solution and then the deposit can be examined.

The normal sputum may contain the red and white blood cells, epithelium from the mouth, trachea, bronchi and alveoli of the lungs. The sputum may

also contain the elastic fibers from the lung, they are somewhat curved and are variable in appearance but are characteristic of the elastic structure. When present it is an indication that the lung is breaking up and is a guide to the practitioner to that extent. The sputum of patients suffering from asthma contains peculiar white twisted and tubular bodies, spoken of Cushman's spirals; in addition there are peculiar crystals present which have been referred to as Charcot-Leyden crystals.

The most important of all that is found in the sputum, perhaps, is the bacillus of Tuberculosis. There are several different methods of examing for the bacillus the one perhaps of most importance, at least in our opinion, is the Ziehl's method because by it the same process can determine their presence in the sputum and the tissue, that being so only one process requires to be remembered. We will describe the method and the stains used. The stain is prepared as follows:

Fuchsin, powdered	1 gm.
Alcohol	10 c. c.

Put these two in a glass mortar and rub them well together then mix wit the following:

Carbolic acid (crystalline)	5 gm.
Distilled water	100 c. c.

To examine the specimen take a cover glass, sterilize by passing through the flame of a spirit lamp, then spread a small spec of the sputum on the cover glass, allow it to dry, and then cover the glass with the above solution heating it for about three minutes, if in a hurry, or simply covering with the stain and waiting for twelve hours, washing off the excess of stain in water and a 25 ° solution of sulphuric acid, then dehydrating in 60 per cent alcohol, counter staining with methylene-blue, or gentian violet, washing again, dehydrate with alcohol, clear up with oil of cloves, and mount in balsam. The bacillus will be red, the tissues blue.

THE PREPARATION OF TISSUES.

The tissues are taken fresh and mixed in solution like corrosive sublimate in a sodium chloride solution for one or two hours. The solution is prepared by placing 1 gm. of bichloride of mercury in 8 c. c. of a half per cent solution of sodium chloride and boiling. The tissue should be cut into small pieces and after fixation washed in 70 per cent alcohol. If the tissue be of some nerve structure it requires to be hardened, this is done by the use of Muller's fluid which is made up of the following substances:

Potassium bichromate	2 gm.
Sodium sulphate	1 gm.
Water	100 c. c.

The spinal cord for example is placed in the solution and allowed to harden, which takes quite a time in some cases, perhaps several months. The

fluid should be sufficient to cover the tissue and if it becomes decolorized the fluid should be renewed. When hard enough it should be washed and then transferred to alcohol.

The tissue requires to be cut for the purpose of examination, this is done after freezing, embedding in paraffin, or celloidin, by the hand or else the microtome is used for the purpose. The celloidin method is the best because the celloidin does not require to be removed before the staining and mounting process like the paraffin. The celloidin is prepared by making a solution of equal parts of alcohol and ether placing the celloidin in this and making one solution of syrupy consistency, another very thin. The tissue is taken, fixed as above, dehydrated by passing through alcohols of different strength (70 per cent for 24 hours; 80 per cent for 24 hours; 90 per cent for 24 hours; absolute alcohol 24 hours) placed in alcohol and ether equal parts for 24 hours then transferred to the thin celloidin solution and left for several days for infiltration. The piece of square wood used for placing the tissue on is then soaked in alcohol, and a box of paper made around it the tissue put in the box and the thick solution poured over the tissue embedding it. The whole mass is placed under a bell jar until the celloidin sets when it is put into 80 per cent alcohol for at least 24 hours when it is ready for cutting. The block with the tissue in it is screwed in the microtome and the cutting of the section is then completed.

The sections require to be stained and this is done by whatever process is applicable to the particular tissue or selected by the experimentor. The stains are variable and each person usually makes choice of some one that is preferable in cases where a preference will not interfere with the process. Hematoxylin is quite a favorite stain and is made as follows: Dissolve 4 gm. of hematoxylin crystals in 25 c. c. of strong alcohol then add this to 400 c. c. of cold filtered solution of ammonia-alum, filter and add glycerine and methylic alcohol each 100 c. c. This requires to be kept in a dark place or else filtered again. The solution is used diluted. Take a section place on a slide, cover with the diluted stain for 5 or 10 minutes then wash in water, dehydrate in alcohol, clear with creasote and mount in balsam. The nucleus is stained by the addition of some eosin after the excess of the hematoxylin is first removed by washing, using an alcohol solution of eosin then carrying out the remainder of the process above mentioned from the addition of some alcohol for dehydration.

The special forms of stains for the special tissues do not require to be considered in this connection, the outline of the process being as much as the extent of this brief resume will permit. These methods are sufficiently given in detail in all of the larger manuals on the subject and can be easily referred to.

The tubercular tissue is stained by the same process mentioned in the

reference to the germ in the sputum with this difference that in this case the germ is in a solid tissue and that tissue must be fixed in some way to the cover glass just in the same way that the sputum can be fixed to it. The section is prepared and cut as referred to but at that stage the section is taken and placed on a cover glass and fixed to it by means of some albuminous fixative. The cover glass is then placed in the staining solution as before and treated as described.

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